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Public Roads

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Late afternoon traffic on the Orleans Street Viaduct, Baltimore, Md.

Public Roads

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BUREAU OF PUBLIC ROADS
U. S. DEPARTMENT OF COMMERCE
E. A. STROMBERG, Editor

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Trends in Traffic Volumes, Vehicle Types and Weights

BY THE HIGHWAY TRANSPORT RESEARCH BRANCH
BUREAU OF PUBLIC ROADS

Reported by
THOMAS B. DIMMICK,
Head, Current Data Analysis Unit

Total travel on all rural roads in 1951 broke all records, exceeding the 1950 previous high by 10 percent. On the 356,000 miles of main rural roads in the United States, travel in 1951 was almost 190 billion vehicle-miles, of which 78 percent was by passenger cars, 1 percent by busses, and 21 percent by freight-carrying vehicles.

Trucks and combinations hauled 4 percent more ton-mileage of freight on main rural roads in 1951 than in 1950. Single-unit truck travel was 2 percent higher than in 1950 while that of combinations increased about 1 percent. The average carried load for all trucks and combinations in 1951 was less than 1 percent above the average in 1950.

In 1951, 5 percent of all trucks and combinations exceeded a State legal weight limit, and 14 percent of the combinations were illegally overloaded in some particular. In comparison with 1950, the percentage of overweight vehicles for 1951 decreased in all regions except New England and the West North Central States.

RURAL MOTOR-VEHICLE TRAVEL broke all previous records in 1951 for the sixth consecutive year. The estimated 1951 traffic on all rural roads was over 10 percent above the 1950 total, 20 percent higher than in 1949, almost 31 percent higher than in 1948, slightly more than 39 percent higher than in 1947, somewhat more than 52 percent higher than in 1946, and almost 53 percent higher than in 1941. Data collected from January through August indicate that travel on all rural roads in 1952 will continue the same general trend and will be almost 7 percent higher than in 1951.

The variation in average daily travel on rural roads by months in the three main geographical divisions[1] and in the United

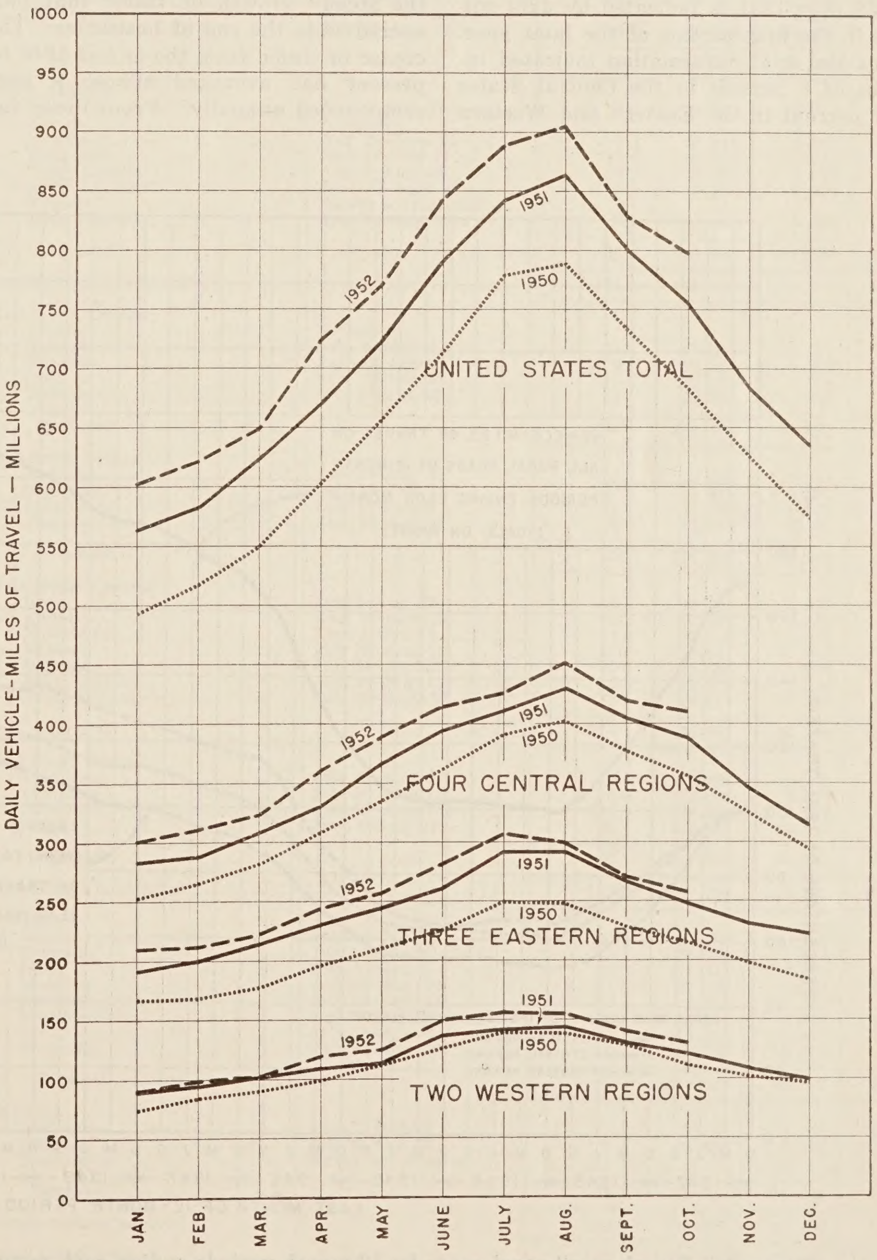

Figure 1.—Travel on all rural roads in 1950, 1951, and in the first 10 months of 1952.

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[1] The States comprising each census region, and the regions comprising each geographic division, are indicated in table 1.

States as a whole is illustrated in figure 1 for the years 1950, 1951, and the first 10 months of 1952. Travel in each month of these years in the Eastern and Central regions and in the United States as a whole was well above that of the corresponding month of the earlier year. The Western region showed only slight gains in January and March of 1952 compared to the amount of travel in 1951 but a fairly steady gain in all other months.

For the three Eastern regions, the chart indicates a somewhat greater increase than that shown by continuous counts at fixed locations because of the upward adjustments of the vehicle-mileage following recent surveys and analyses by Georgia and New York, more comprehensive than those previously made. Similar adjustments in other regions, following new surveys and analyses, did not result in changes of appreciable significance.

Approximately the same rate of increase in 1952 over 1951 is indicated by data collected in the first portion of the later year. The partial 1952 information indicated increases of 6 percent in the Central States and 7 percent in the Eastern and Western States. The largest indicated increase over 1951 in any census region was 10 percent in the East South Central; the smallest increase was 5 percent in the Middle Atlantic region.

Summer travel constituted a smaller portion of the annual travel in 1951 than in any recent year. In the last two prewar years (1940 and 1941), the average daily traffic in July and August was 23 percent above the average traffic for the year. Not until 1949 did the summer travel reach the prewar ratio. In 1950 the average daily summer travel was over 24 percent above the annual average daily amount, but this figure slumped to 22 percent in the 1951 summer season.

Figure 2, showing travel on all rural roads by 12-month periods ending each month (moving average) and as a percentage of traffic in the calendar year 1941, gives an accurate picture of the effect of wartime restrictions on prewar travel and the steady growth of traffic that has occurred since the end of hostilities. The increase in traffic from the end of 1946 to the present has averaged almost 9 percent, compounded annually. From these data it is apparent that the general pattern of traffic growth is being maintained with no evidence of its leveling off.

The lower portion of figure 2, showing the relation of travel by 12-month periods in each of the main geographical regions of the United States to that in the calendar year 1941, shows clearly how much travel was shifted westward during the war. The spread between the curves for the three regions remained constant during 1947 and 1948, was reduced slightly during 1949 and 1950, and was greatly reduced in 1951 and the portion of 1952 shown.

Basis of Estimates

During certain prewar years, generally 1936 or 1937, nearly every State conducted a comprehensive survey of traffic in which all vehicles counted were classified by type. At the same time a large number of trucks and truck combinations were stopped and weighed and information recorded concerning their weight, dimensions, and other important features.

While the large number of automatic recorders operated on the rural roads of

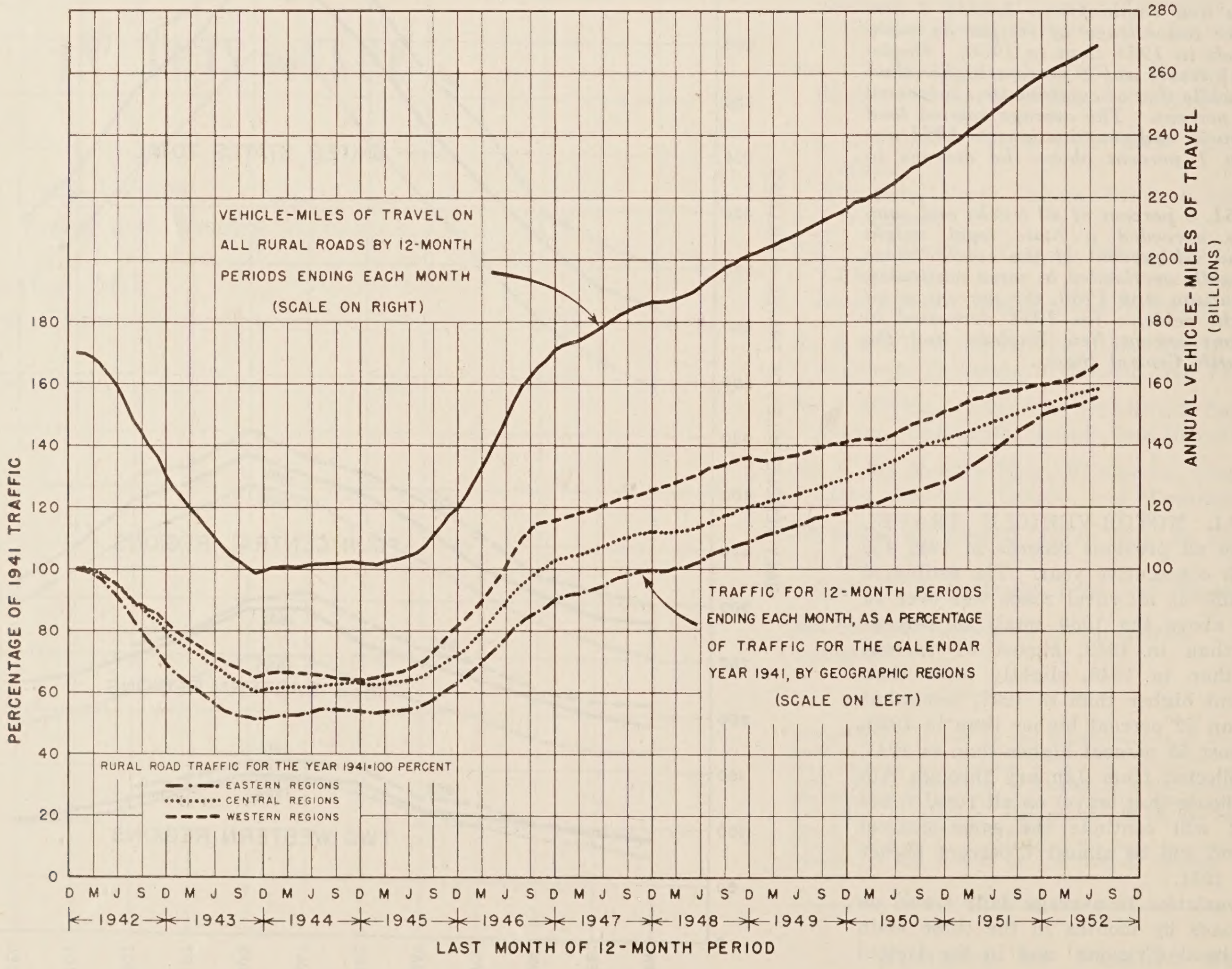

Figure 2.—Travel on all rural roads by 12-month periods ending each month, in vehicle-miles and as a percentage of traffic in the calendar year 1941.

each State give a good indication of the trend of total traffic on these highways, they provide no indication of the classification of vehicles by type, weight, or other characteristics. In order to determine the trends in such factors, brief check surveys were made in the summer of 1942 at certain typical stations in most States. From strictly comparable information gathered in the two surveys, trends were calculated which were used to determine the changes in traffic and vehicle characteristics that had taken place since the comprehensive survey was made. Since 1942, check surveys have been made annually. Most States have participated in these each year and all have participated at some time.[2] Such surveys were conducted in 45 States in 1951, although two States, Virginia and Washington, were unable to analyze their data in time to be included in this report.

Classification counts made in numerous States, in addition to those made at weight stations, added valuable information concerning vehicle-type proportions. Greatly expanded loadometer surveys made throughout the year in a few States have furnished more reliable data concerning vehicle types and weights than can be obtained from trend data alone. Starting in the summer of 1950, a number of weight stations were selected in 26 States from which data concerning weights and characteristics of truck traffic were to be used in studying loads and their relation to pavement damage. These stations generally are operated 16 or 24 hours a day and at least one day each season. The new data derived from these more extensive operations give more information concerning traffic characteristics in various hours of the day and seasons of the year than has been available at any time since the time of the initial surveys. All of these data wherever available have been used in the estimates.

1951 Summer Loadometer Survey

The stations used in the check surveys were selected initially to give a representative cross section of traffic on main rural roads. They were operated for one or more 8-hour periods on a weekday, generally from either 6 a.m. to 2 p.m. or from 2 p.m. to 10 p.m. All traffic passing through the stations during the period was counted and classified into the following categories: local passenger cars; foreign (out-of-State) passenger cars; panel and pick-up trucks; other two-axle, four-tire trucks; two-axle, six-tire trucks; three-axle trucks; truck-tractor and semitrailer combinations; truck and trailer combination or truck-tractor semitrailer and trailer combinations; and busses. The combination-type vehicles were further subdivided according to number of axles of each.[3]

Most of the weight stations were operated during July, August, and September. The survey period, number of stations operated, number of vehicles counted, and the number weighed are shown for each State in table 1. More than 1.7 million vehicles were

Table 1.—Survey period, number of stations operated, number of vehicles counted, and number weighed in each State in the special weight surveys, summer of 1951

Region and State	Survey period	Number of stations	Total vehicles counted	Trucks and truck combinations: Counted	Trucks and truck combinations: Weighed
New England:					
Connecticut	Aug. 1–Aug. 24	10	36,695	6,820	1,665
Maine	July 5–Aug. 3	9	46,899	8,132	3,334
Massachusetts	July 23–Aug. 13	10	116,163	14,817	4,380
New Hampshire	No survey	...	...	...	...
Rhode Island	July 16–Aug. 9	5	37,703	4,921	2,145
Vermont	July 23–Aug. 9	5	22,890	1,834	1,698
Subtotal		39	260,350	36,524	13,222
Middle Atlantic:					
New Jersey	July 30–Aug. 8	10	96,500	15,205	2,069
New York	July 18–July 30	20	34,425	8,072	1,522
Pennsylvania	July 16–Aug. 31	13	70,602	15,425	3,133
Subtotal		43	201 527	38,702	6,724
South Atlantic:					
Delaware	Aug. 9–Aug. 27	8	28,921	6,033	1,106
Florida	No survey	...	...	...	...
Georgia	Aug. 20–Sept. 25	15	37,116	9,663	4,489
Maryland	June 18–July 17	10	99,676	20,042	3,588
North Carolina	Aug. 2–Aug. 28	12	31,975	6,946	4,153
South Carolina	Sept. 17–Sept. 28	10	19,783	5,276	2,095
Virginia	Survey not reported	...	...	...	...
West Virginia	Aug. 14–Aug. 30	9	14,494	3,583	1,513
Subtotal		64	231,965	51,543	16,944
Eastern regions, subtotal		146	693,842	126,769	36,890
East North Central:					
Illinois	No survey	...	...	...	...
Indiana	Aug. 8–Sept. 6	20	55,770	13,171	4,724
Michigan	June 12–July 18	9	29,823	6,202	2,208
Ohio	July 10–July 26	10	29,570	5,694	1,514
Wisconsin	July 2–Sept. 25	19	90,241	13,410	3,181
Subtotal		58	205,404	38,477	11,627
East South Central:					
Alabama	July 17–Aug. 21	10	32,599	8,121	6,182
Kentucky	July 11–Aug. 17	10	39,679	9,287	3,470
Mississippi	July 11–July 6	15	27,469	6,757	3,734
Tennessee	Aug. 21–Sept. 5	10	15,076	4,203	1,756
Subtotal		45	114,823	28,368	15,142
West North Central:					
Iowa	July 1–Aug. 31	10	33,348	5,932	5,220
Kansas	Aug. 10–Sept. 13	10	10,484	2,260	571
Minnesota	June 4–Oct. 18	14	59,110	10,677	3,671
Missouri	July 30–Aug. 28	21	176,641	32,948	11,973
Nebraska	July 19–Aug. 22	20	27,015	5,604	5,373
North Dakota	July 10–Aug. 31	14	24,179	5,036	1,811
South Dakota	July 30–Sept. 17	15	24,174	3,899	3,601
Subtotal		104	354,951	66,356	32,220
West South Central:					
Arkansas	July 23–Aug. 3	10	17,381	5,802	1,371
Louisiana	July 30–Aug. 13	10	13,089	3,620	1,138
Oklahoma	July 11–Aug. 10	10	28,995	6 526	5,983
Texas	June 1–Aug. 31	20	108,115	23,583	5,535
Subtotal		50	167,580	39,531	14,027
Central regions, subtotal		257	842,758	172,732	73,016
Mountain:					
Arizona	July 16–July 27	10	10,291	2,245	590
Colorado	July 2–Sept. 4	13	26,226	3,664	846
Idaho	Aug. 7–Sept. 6	10	15,441	3,003	1,484
Montana	July 30–Aug. 31	11	27,498	5,121	2,118
Nevada	July 31–Aug. 17	10	8,924	1,560	708
New Mexico	Aug. 6–Aug. 20	10	15,194	3,372	1,516
Utah	July 16–Aug. 3	10	19,879	3,672	1,092
Wyoming	July 31–Aug. 20	10	12,610	2,255	767
Subtotal		84	136,063	24,892	9,121
Pacific:					
California	June 7–July 18	17	[1] 72,180	13,902	4,226
Oregon	Aug. 8–Aug. 23	8	19,852	3,965	2,187
Washington	Survey not reported	...	...	...	...
Subtotal		25	92,032	17,867	6,413
Western regions, subtotal		109	228,095	42,759	15,534
United States total		512	1,764,695	342,260	125,440

[1] Passenger cars not counted; figure given is an estimate based on data from other reports.

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[2] See *Traffic trends on rural roads,* by T. B. Dimmick, PUBLIC ROADS, vol. 26, No. 11, Dec. 1951; vol. 26, No. 5, Dec. 1950; vol. 25, No. 12, Feb. 1950; vol. 25, No. 7, Mar. 1949; vol. 25, No. 3, Mar. 1948; vol. 24, No. 10, Oct.-Nov.-Dec. 1946; and *Amount and characteristics of trucking on rural roads,* by J. T. Lynch and T. B. Dimmick, PUBLIC ROADS, vol. 23, No. 9, July-Aug.-Sept. 1943.

[3] In this article, the term "truck" is used to indicate a single-unit vehicle; "truck combination" to indicate truck-tractor semitrailer (with or without full trailer) and truck with full trailer; and "truck and truck combinations" or "trucks and combinations" to indicate all of these vehicles together.

counted at all stations during the period of the survey. Almost one-fifth of these were freight-carrying vehicles, of which almost 37 percent were weighed.

Wherever traffic volume permitted, each truck and truck combination was stopped and weighed. Where this procedure was impracticable, all of the less common types were weighed and the common vehicle types were weighed in sufficient numbers to establish their characteristics from the sample. The type of vehicle, whether loaded or empty, the number of axles, and the weight of each axle were recorded. The axle-spacing and the total wheelbase length of the heavier vehicles[4] were measured. Passenger cars and busses were counted but not stopped for weighing.

Prewar Traffic Trend Increased

Figure 3 shows in chart form the vehicle-mileage of travel on all rural roads, by vehicle types, for each year from 1936 to 1951, inclusive. It is apparent that the effect of the drastic restrictions on travel during the war period, 1942-45, caused but a temporary dip in traffic growth and that the 1951 vehicle-mileage was as high as would have been estimated by any rational projection of the prewar trend. A straight line from the top of the bar for 1936 to the top of the bar for 1951 passes through the top of the bar for 1937 and for 1941 and falls well above the tops of the bars for all other years. This line indicates an average (simple) increase over the 15 years of almost 7.4 percent a year. This is equivalent to a rate of 5.1 percent compounded annually. The period 1936 to 1941 has much in common with the period 1946 to 1951, inclusive. During both periods the trend was quite uniform for the first 4 years but there was an upsurge of traffic in the fifth year. Traffic levels were considerably higher in the 1946 to 1951 period than in the earlier one, and the rate of increase was greater. During the earlier 5-year period the total increase was 38 percent, while during the later 5-year period it was 52 percent, or an average of 8.7 percent a year, compounded annually.

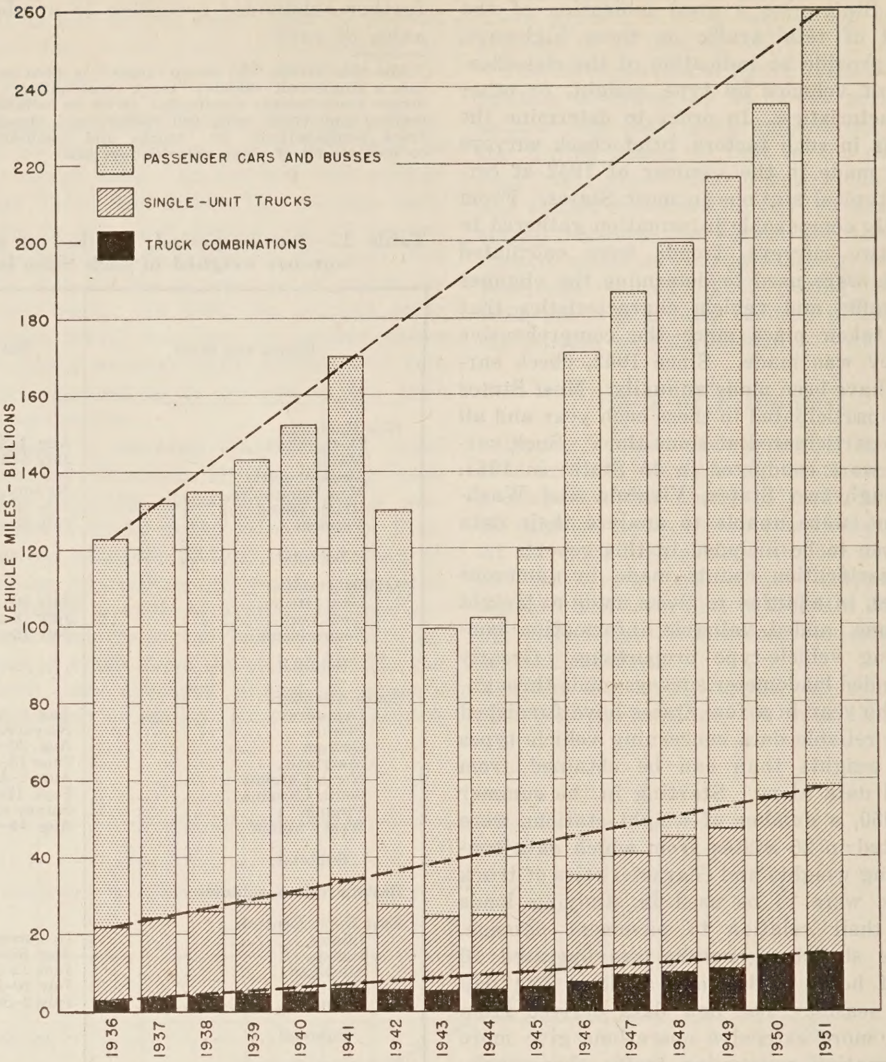

Figure 3.—Travel on all rural roads, 1936–51, by classes of vehicles.

Travel by trucks and truck combinations increased in a manner very similar to that observed for all vehicles. For truck combinations alone, the 1936–51 line lies above the tops of all bars from 1937 to 1949, inclusive, thus showing an accelerating upward trend in the travel by these heavier vehicles. This trend is emphasized by other data given in other portions of this report.

As previously stated, the traffic data collected at automatic traffic-recorder stations in the first half of 1952 indicate that travel by all types of vehicles has continued to increase over that in the same months of

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[4] Trucks and truck combinations weighing 13 tons or more, or having an axle weighing 18,000 pounds or more.

Table 2.—Ratio of 1951 traffic on main rural roads to corresponding traffic in 1950[1]

Vehicle type	Eastern regions				Central regions					Western regions			United States average
	New England	Middle Atlantic	South Atlantic	Average	East North Central	East South Central	West North Central	West South Central	Average	Mountain	Pacific	Average	
Passenger cars:													
Local	1.19	1.08	1.22	1.15	1.07	1.17	1.16	1.15	1.12	1.15	1.06	1.08	1.13
Foreign	.98	.92	1.18	1.05	1.05	1.17	1.07	1.07	1.08	.94	1.19	1.03	1.06
All passenger cars	1.13	1.04	1.21	1.13	1.06	1.17	1.14	1.13	1.11	1.06	1.07	1.07	1.11
Trucks and combinations:													
Single-unit trucks	.83	1.01	1.04	1.00	1.00	.98	.97	1.08	1.01	.99	1.21	1.10	1.02
Truck combinations	.92	1.00	.94	.96	1.00	1.05	1.04	1.10	1.03	.92	1.10	1.04	1.01
All trucks and combinations	.85	1.01	1.01	.99	1.00	1.00	.99	1.09	1.02	.97	1.17	1.08	1.02
Busses	1.09	1.22	1.00	1.08	.96	.95	.95	1.00	.97	.87	1.00	.95	1.00
All vehicles	1.07	1.04	1.16	1.10	1.05	1.11	1.10	1.12	1.09	1.04	1.09	1.07	1.09

[1] The ratios for "all vehicles" are based on year-around automatic recorder data, while those for the individual vehicle types are based principally on summer counts.

Table 3.—Percentage distribution of travel, by vehicle type, on main rural roads in the summer of 1951

Vehicle type	Eastern regions				Central regions					Western regions			United States average
	New England	Middle Atlantic	South Atlantic	Average	East North Central	East South Central	West North Central	West South Central	Average	Mountain	Pacific	Average	
Passenger cars:													
Local	61.47	64.32	59.57	61.66	55.71	46.27	62.19	60.29	57.01	48.10	68.80	61.24	59.26
Foreign	22.31	14.31	19.17	17.72	22.77	23.94	15.14	14.30	19.03	29.78	11.30	18.05	18.43
All passenger cars	83.78	78.63	78.74	79.38	78.48	70.21	77.33	74.59	76.04	77.88	80.10	79.29	77.69
Single-unit trucks:													
Panel and pick-up	4.12	4.81	6.83	5.68	5.30	10.70	7.21	11.10	7.98	9.57	5.04	6.69	7.00
Other 2-axle, 4-tire	.80	1.06	.52	.77	.29	.41	.61	.43	.42	.63	1.10	.93	.62
Other 2 axle, 6-tire	5.83	7.21	6.42	6.65	6.06	10.64	8.07	5.92	7.15	5.67	4.56	4.97	6.62
3-axle	.32	.50	.41	.43	.32	.35	.32	.16	.28	.42	1.10	.85	.43
All single-unit trucks	11.07	13.58	14.18	13.53	11.97	22.10	16.21	17.61	15.83	16.29	11.80	13.44	14.67
Truck-tractor and semitrailer combinations:													
3-axle	3.51	5.11	3.56	4.15	4.38	5.01	2.45	3.76	3.87	1.58	1.09	1.27	3.52
4-axle	0.39	1.70	2.43	1.87	3.56	1.22	2.58	2.86	2.82	1.18	1.06	1.10	2.22
5-axle or more	(1)	.02	.01	.01	.21	.02	.43	.06	.20	1.33	2.99	2.39	.50
All truck-tractor and semitrailer combinations	3.90	6.83	6.00	6.03	8.15	6.25	5.46	6.68	6.89	4.09	5.14	4.76	6.24
Truck and trailer combinations:													
4-axle or less	.01	.04	.01	.02	.15	.01	.27	.25	.18	.14	.33	.26	.14
5-axle	....	.01	....	.01	.43	....	.01	(1)	.16	.46	.88	.73	.21
6-axle or more	....	....	....	....	.09	....	.01	....	.04	.19	.84	.60	.12
All truck and trailer combinations	.01	.05	.01	.03	.67	.01	.29	.25	.38	.79	2.05	1.59	.47
All combinations	3.91	6.88	6.01	6.06	8.82	6.26	5.75	6.93	7.27	4.88	7.19	6.35	6.71
All trucks and truck combinations	14.98	20.46	20.19	19.59	20.79	28.36	21.96	24.54	23.10	21.17	18.99	19.79	21.38
Busses	1.24	.91	1.07	1.03	.73	1.43	.71	.87	.86	.95	.91	.92	.93
All vehicles	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[1] Less than 0.005 percent.

1951. Available information indicates that travel on rural roads in 1952 will exceed the 1951 total by about 7 percent.

Travel Increases

The State system of highways in most States is composed of the main rural roads, or those on a connected system carrying the heaviest traffic. In such States as North Carolina, Pennsylvania, and Virginia, where all or a large part of the rural mileage is under State control, only the primary roads are included in this report as a part of the "main" system of highways of the country. These main roads, comprising about 356,000 miles, include less than 12 percent of the total rural mileage but carry over 73 percent of the total rural traffic. Because of the greater importance of these highways, from a traffic standpoint, most of the current traffic data were collected at points on them, and the remainder of this report will be concerned only with information concerning this portion of the road mileage.

The ratio of traffic volumes on main rural roads in 1951 to corresponding volumes in the previous year is shown in table 2. Although travel in 1951 on the main highways was higher in every region than in 1950, and the general increase for the United States as a whole was the same as in the previous year, the increase in travel of single-unit trucks, truck combinations, and foreign (out-of-State) passenger cars was considerably less than in the previous year and travel in these categories decreased in several regions. For instance, the table indicates that in 1951 travel by trucks was less in New England, East South Central, West North Central, and Mountain regions than in 1950 while truck combination traffic was less in New England, South Atlantic, and Mountain regions than in 1950. Likewise, travel by foreign passenger cars was less in the New England, Middle Atlantic, and Mountain regions while bus traffic in-

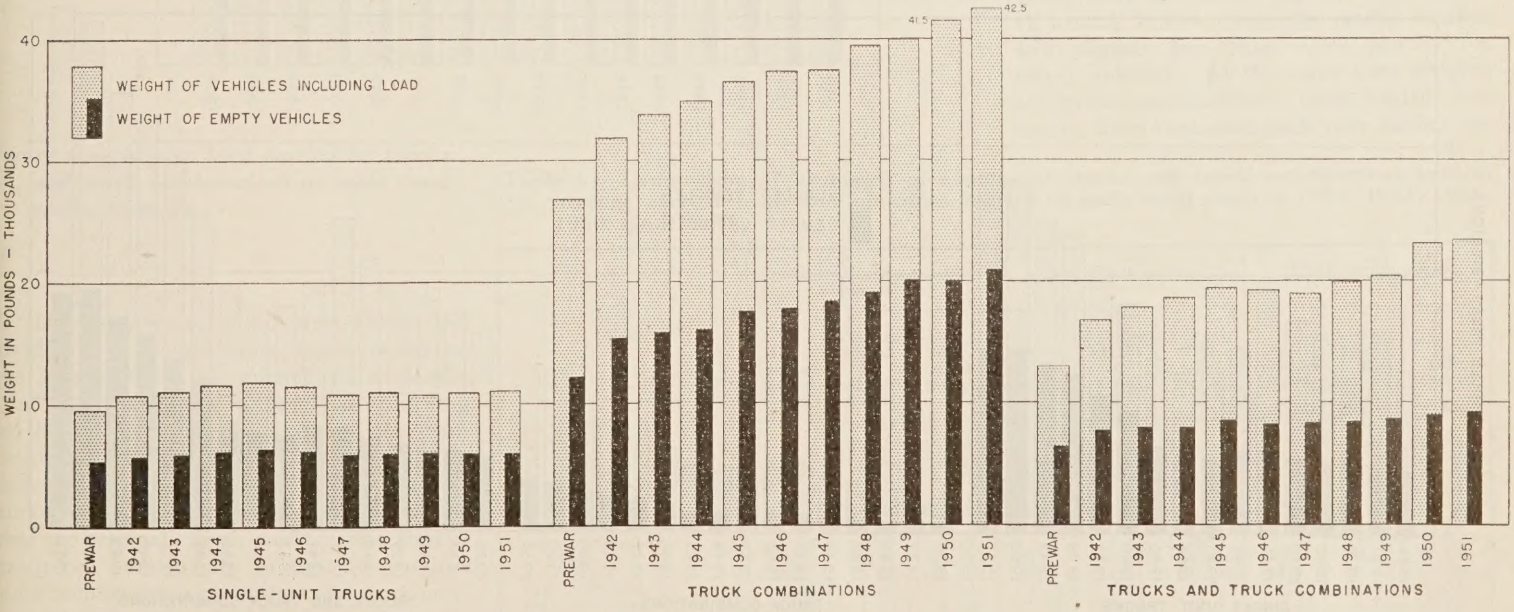

Figure 4.—Average weights of loaded and empty trucks and truck combinations in the summers of 1942-51 and a prewar year.

Table 4.—Average weight (in pounds) of loaded and empty trucks and truck combinations, by vehicle types, in the summer of 1951

Vehicle type	Eastern regions				Central regions					Western regions			United States average
	New England	Middle Atlantic	South Atlantic	Average	East North Central	East South Central	West North Central	West South Central	Average	Mountain	Pacific	Average	
AVERAGE WEIGHTS OF LOADED VEHICLES													
Single-unit trucks:													
Panel and pick-up	5,072	5,312	4,876	5,081	5,239	5,336	5,159	7,162	5,898	5,154	4,432	4,750	5,498
Other 2-axle, 4-tire	6,522	6,719	6,785	6,717	6,623	6,734	7,233	6,746	6,898	6,877	5,674	5,910	6,522
Other 2-axle, 6-tire	14,776	15,813	13,007	14,411	13,572	14,163	14,755	13,693	14,031	14,378	12,899	13,430	14,069
3-axle	31,746	37,544	27,268	32,397	27,449	26,764	28,378	28,217	27,700	32,186	29,302	29,717	29,924
Average	11,873	13,048	10,796	11,892	10,754	11,089	11,123	9,897	10,691	10,078	10,890	10,598	11,024
Truck combinations:													
Truck-tractor and semitrailer	40,212	42,705	39,128	40,771	39,730	35,052	41,548	39,135	39,399	46,153	50,656	49,445	41,373
Truck and trailer	(1)	(1)	(1)	53,856	66,785	(1)	32,343	59,364	58,778	65,143	57,397	58,601	58,599
Average	40,199	42,810	39,005	40,814	41,315	35,061	41,115	39,912	40,143	48,785	52,297	51,439	42,501
Average, all trucks and combinations	21,014	24,572	22,060	23,062	25,821	18,190	20,469	20,955	22,254	22,151	29,213	26,992	23,376
AVERAGE WEIGHTS OF EMPTY VEHICLES													
Single-unit trucks:													
Panel and pick-up	4,082	4,109	3,822	3,927	4,065	4,120	4,119	5,010	4,425	4,026	3,861	3,959	4,210
Other 2-axle, 4-tire	4,997	4,652	5,309	4,894	4,907	4,629	5,162	5,232	5,032	5,223	4,523	4,770	4,924
Other 2-axle, 6-tire	8,858	8,865	7,359	8,160	8,131	7,926	8,275	8,151	8,120	8,031	8,292	8,153	8,137
3-axle	14,707	17,174	13,705	15,297	12,896	15,169	12,819	18,959	14,257	16,696	16,231	16,356	15,187
Average	6,599	6,738	5,276	5,930	5,990	5,806	6,081	6,063	5,622	5,442	6,080	5,730	5,937
Truck combinations:													
Truck-tractor and semitrailer	21,838	21,033	19,423	20,360	19,719	18,991	21,256	19,343	19,770	24,742	23,509	24,179	20,282
Truck and trailer	(1)	(1)	(1)	19,763	26,442	(1)	18,778	52,760	28,648	30,734	27,668	28,414	28,325
Average	21,777	21,037	19,417	20,357	20,529	18,992	21,114	20,402	20,360	26,033	25,605	25,789	20,911
Average, all trucks and combinations	9,559	10,607	8,069	9,167	10,555	7,933	9,024	8,944	8,910	8,407	10,252	9,280	9,197

[1] Data omitted because of insufficient sample.

creased in New England and Middle Atlantic, decreased in East North Central, East South Central, West North Central, and Mountain regions and remained about the same in other regions.

The increase in travel by all types of passenger vehicles amounted to 11 percent compared to only 2 percent for freight-carrying vehicles. This small increase in truck and truck combination traffic is particularly noteworthy when it is noted that there was an extremely large increase in that traffic in 1950 compared to the previous year. The increase in travel by passenger cars was 7 percent while the increase in travel by all types of freight-carrying vehicles amounted to 18 percent, the increase being 12 percent for single-unit trucks and 33 percent for truck combinations. Thus the 1951 figures show that the extremely rapid rate of increase in truck traffic which occurred from 1949 to 1950 was not continued into 1951. However, such data as are available for 1952 indicate that this leveling off may have been temporary, and that truck traffic may again be increasing faster than passenger car traffic.[5]

The percentage of travel by vehicle types on main rural roads in 1951 is given in table

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[5] Preliminary data from Alabama, Connecticut, Delaware, Maine, Missouri, Nevada, North Carolina, Oregon, and Vermont show a 13 percent increase in travel by trucks and combinations in 1952 compared to 1951.

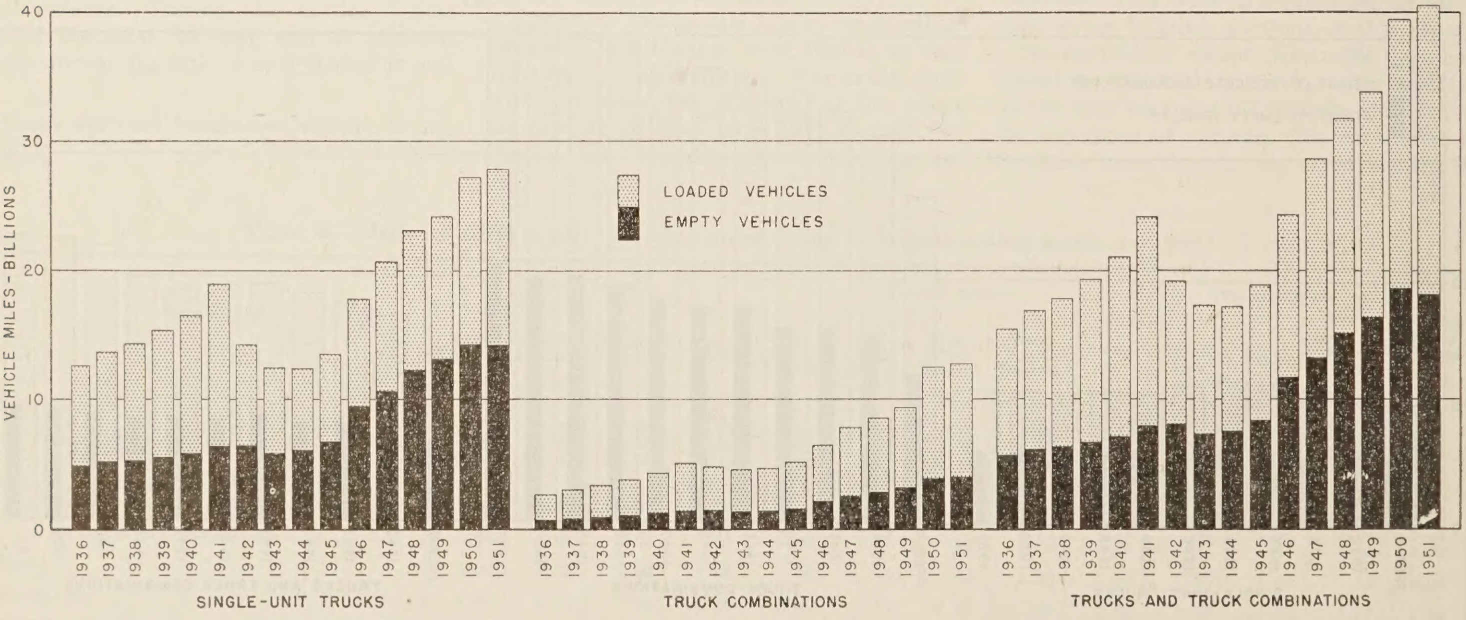

Figure 5.—Travel on main rural roads, 1936–51, by loaded and by empty trucks and truck combinations.

Table 5.—Comparison of estimated vehicle-miles of travel on main rural roads in 1936, 1941, 1946, 1950, and 1951

Year	All vehicles, vehicle-miles	Passenger cars and busses [1]		All trucks and truck combinations		Single-unit trucks		Truck combinations	
		Percentage of all vehicles	Vehicle-miles	Percentage of all vehicles	Vehicle-miles	Percentage of all trucks and truck combinations	Vehicle-miles	Percentage of all trucks and truck combinations	Vehicle-miles
	Millions		*Millions*		*Millions*		*Millions*		*Millions*
1936	88,412	82.6	73,005	17.4	15,407	82.1	12,650	17.9	2,757
1941	122,505	80.3	98,320	19.7	24,185	78.8	19,057	21.2	5,128
1941:1936 ratio	*1.39*	*.97*	*1.35*	*1.13*	*1.57*	*.96*	*1.51*	*1.18*	*1.86*
1946	124,149	80.4	99,803	19.6	24,346	73.3	17,838	26.7	6,508
1946:1941 ratio	*1.01*	*1.00*	*1.02*	*.99*	*1.01*	*.93*	*.94*	*1.26*	*1.27*
1946:1936 ratio	*1.40*	*.97*	*1.37*	*1.13*	*1.58*	*.89*	*1.41*	*1.49*	*2.36*
1950	174,349	77.2	134,528	22.8	39,821	68.4	27,256	31.6	12,565
1951	189,651	78.6	149,110	21.4	40,541	68.6	27,810	31.4	12,731
1951:1950 ratio	*1.09*	*1.02*	*1.11*	*.94*	*1.02*	*1.00*	*1.02*	*.99*	*1.01*
1951:1941 ratio	*1.55*	*.98*	*1.52*	*1.09*	*1.68*	*.87*	*1.46*	*1.48*	*2.48*
1951:1936 ratio	*2.15*	*.95*	*2.04*	*1.23*	*2.63*	*.84*	*2.20*	*1.75*	*4.62*

[1] Percentages of total 1951 travel by passenger cars and by busses are reported separately in table 3.

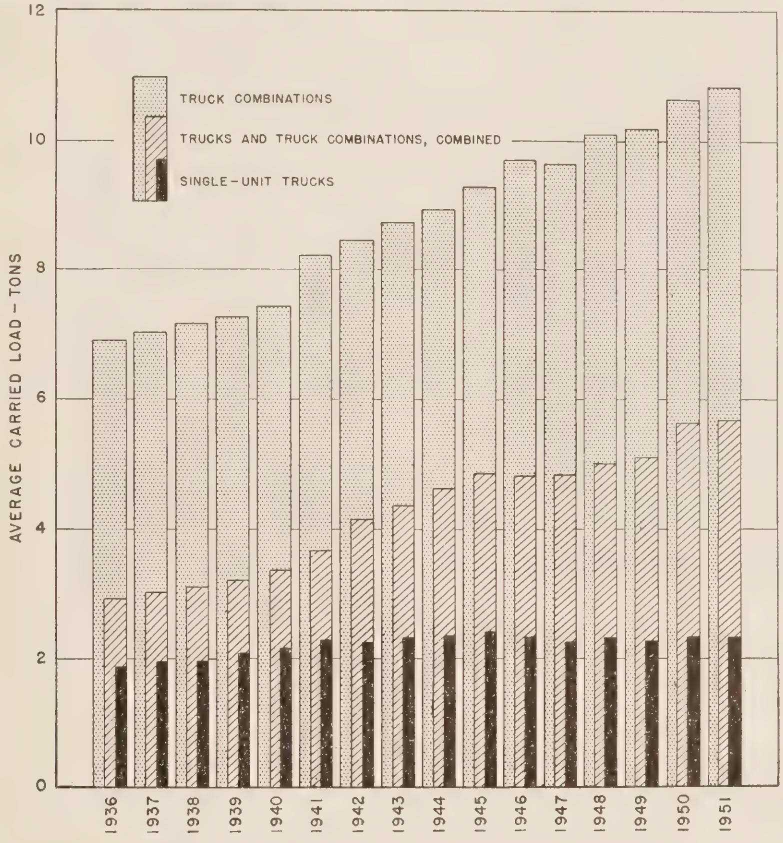

Figure 6.—Average load carried by trucks and truck combinations on main rural roads, 1936–51.

3. In this table all single-unit trucks are divided into classification types based on the axle and tire arrangements, while the truck combinations are classified according to the total number of axles of the combination. The classification of vehicles into these types has been used in the last five annual surveys. It has several advantages over the original "light, medium, and heavy" grouping, particularly in that it provides more homogeneous groupings and more positive identification of the types. It is regrettable that no direct comparison can be made by vehicle types between the old and the new classifications, or between data collected in 1946 and earlier years with such data collected in 1947 and thereafter, but the convenience and advantages of the new system outweigh the disadvantages caused by the change.

The data in table 3 indicate that truck and truck combination travel in 1951 was more than 20 percent of the total travel in all but the New England and Pacific regions. It was between 20 and 25 percent in all remaining regions except the East South Central region where it was over 28 percent.

A comparison with the same table in the 1950 report shows that the proportion of trucks was lower in 1951 than in 1950 in every region except the Pacific region where the proportion of freight-carrying vehicles increased slightly.

Table 3 indicates also that the usage of certain types of freight-carrying vehicles varies in different sections. For instance, the truck and trailer combinations with six or more axles and the truck-tractor and semitrailer with five or more axles are used far more frequently in the Pacific region than in any other area. Truck and trailer combinations are used much less in the East South Central region and in the three eastern regions than in other sections. The percentage of combination-type vehicles, nation-wide, was 6.71 percent, a slight decrease from the 1950 figure of 7.21 percent but exceeding the percentage figures of 5.95 in 1949, 5.84 in 1948, 5.73 in 1947, and 5.26 in 1946.

The average weights of loaded and empty trucks and truck combinations, separately and combined, are shown graphically in figure 4 for each year from 1942 to 1951, inclusive, and for a prewar year, generally 1936 or 1937. The weights of single-unit trucks, both loaded and empty, increased each year from the 1936–37 period through 1945, then decreased slightly and leveled off around 11,000 pounds for loaded vehicles and slightly less than 6,000 pounds for empty vehicles. At the same time weights of truck combinations, both loaded and empty, have increased each year during the

Table 6.—Comparison of estimated percentage of trucks and truck combinations loaded, average carried load, and ton-miles carried on main rural roads in 1936, 1941, 1946, 1950, and 1951

Year	All trucks and truck combinations			Single-unit trucks			Truck combinations		
	Percentage loaded	Average weight of carried load	Ton-miles carried	Percentage loaded	Average weight of carried load	Ton-miles carried	Percentage loaded	Average weight of carried load	Ton-miles carried
		Tons	*Millions*		*Tons*	*Millions*		*Tons*	*Millions*
1936	62.8	2.90	28,005	60.7	1.86	14,258	72.2	6.90	13,747
1941	66.7	3.64	58,737	65.4	2.29	28,487	71.6	8.23	30,250
1941:1936 ratio	*1.06*	*1.26*	*2.10*	*1.08*	*1.23*	*2.00*	*.99*	*1.19*	*2.20*
1946	51.7	4.84	60,892	46.4	2.31	19,101	66.2	9.70	41,791
1946:1941 ratio	*.78*	*1.33*	*1.04*	*.71*	*1.01*	*.67*	*.92*	*1.18*	*1.38*
1946:1936 ratio	*.82*	*1.67*	*2.17*	*.76*	*1.24*	*1.34*	*.92*	*1.41*	*3.04*
1950	53.9	5.64	121,091	47.2	2.31	29,645	68.5	10.62	91,446
1951	55.1	5.66	126,402	48.8	2.31	31,396	68.9	10.83	95,006
1951:1950 ratio	*1.02*	*1.00*	*1.04*	*1.03*	*1.00*	*1.06*	*1.01*	*1.02*	*1.04*
1951:1941 ratio	*.83*	*1.55*	*2.15*	*.75*	*1.01*	*1.10*	*.96*	*1.32*	*3.14*
1951:1936 ratio	*.88*	*1.95*	*4.51*	*.80*	*1.24*	*2.20*	*.95*	*1.57*	*6.91*

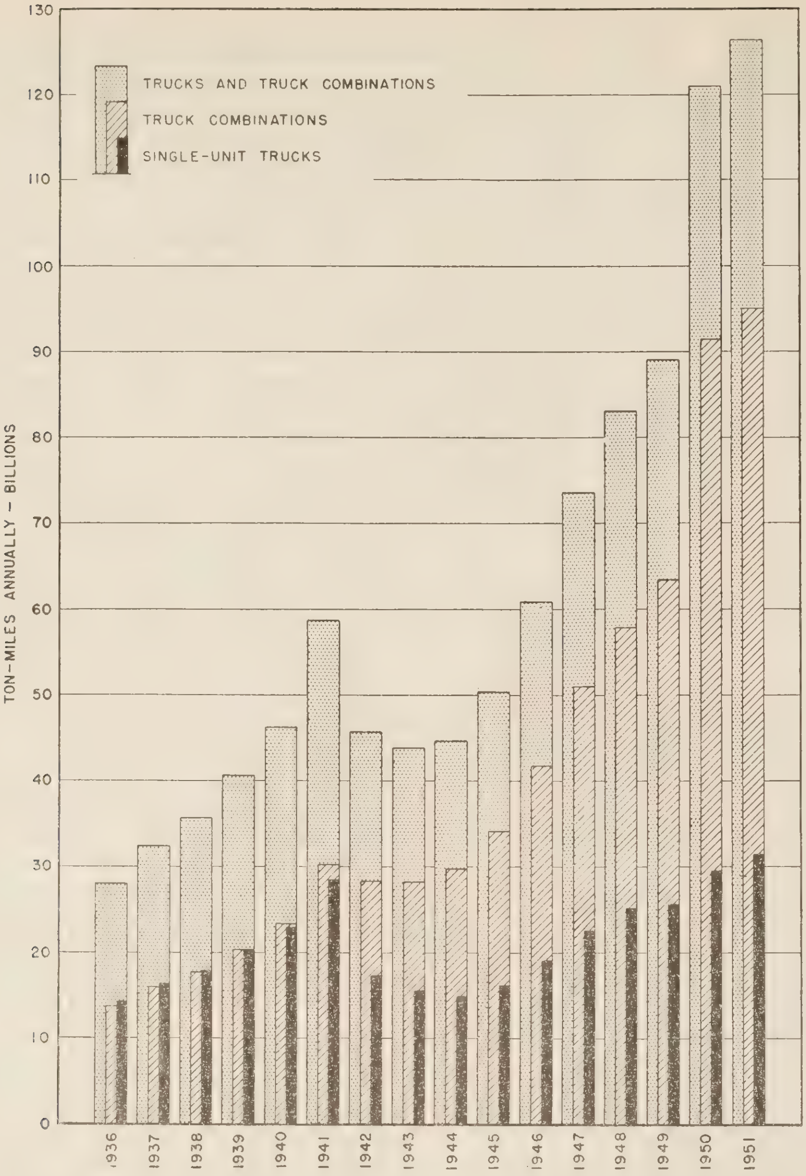

Figure 7.—Ton-miles carried by trucks and truck combinations on main rural roads, 1936-51.

period shown. The increase in average weight of loaded combinations from the 1936–37 period to 1951 was over 58 percent, compared to 12 percent for single-unit trucks.

The increase for all loaded trucks and truck combinations combined was slightly more than 80 percent. It will be noted that the average weight of the loaded single-unit trucks was somewhat less than twice the average weight of the empty vehicles of this type, while the average weight of the loaded combinations was just about twice the average weight of the empty combinations. In the case of the vehicles of both types combined, the loaded vehicles included a higher proportion of combinations than the empty vehicles, since combinations are more often loaded and the average weight of the loaded trucks and combinations was therefore considerably more than twice the average weight of the empty vehicles of both types.

The average weights of the various types of loaded and empty trucks and truck combinations in the summer of 1951 are shown in table 4 for the different regions. This table brings out clearly the important differences that exist in the weight characteristics of the vehicles in the different groups. It will be noted, for example, that for the United States as a whole, the loaded three-axle, single-unit trucks weighed a little more than twice as much as the two-axle, six-tire trucks. The latter, in turn, weighed a little more than twice as much as the two-axle, four-tire trucks. Similar differences existed throughout the various classifications. On the other hand, the regional differences in average weight for each of the vehicle types that are common throughout the country are surprisingly small. The rather low weights of truck and trailer combinations in certain sections of the country, particularly the West North Central region, indicate a predominance of small home-made trailers of low capacity.

Seasonal loadometer data for 1952 and a corresponding period in 1951, received from 9 States as previously referred to, indicate that in 1952 the loaded single-unit trucks were about 4 percent lighter, and the empty trucks about 8 percent lighter, on the average, than in 1951. The loaded tractor-semitrailer combinations were less than 1 percent heavier than in 1951 and the empty combinations about 3 percent heavier. These data indicated no change in the percentage of loaded single-unit trucks, but an appreciable increase in the percentage of truck combinations loaded.

Truck Travel Increases

Figure 5 shows the estimated vehicle-mileage of travel by loaded and empty single-unit trucks and truck combinations, separately and combined, on main rural roads for each year 1936 to 1951, inclusive. This chart demonstrates graphically the steady growth of truck traffic during the prewar years 1936–41, the temporary effect of wartime restrictions in the period 1942–45, and the remarkable increases in truck transportation that have occurred since the end of hostilities in 1945.

Table 5 gives comparisons of the estimated vehicle-mileage of travel by vehicles of different types on all main rural roads

Table 7.—Percentage of vehicle-miles of travel, percentage loaded, average carried load, and percentage of total ton-miles carried by various types of trucks and truck combinations on main rural roads in 1951 compared to that in corresponding months of 1950

Vehicle type	Percentage of vehicle-miles of travel		Percentage loaded		Average carried load		Percentage of ton-miles carried	
	1951	1950	1951	1950	1951	1950	1951	1950
					Tons	*Tons*		
Single-unit trucks:								
Panel and pick-up	32.76	31.35	39.0	37.4	0.70	0.69	2.86	2.65
Other 2-axle, 4-tire	2.90	2.79	54.6	52.4	.91	.93	.46	.45
Other 2-axle, 6-tire	30.94	32.63	58.0	55.9	3.23	3.20	18.57	19.06
3-axle	2.00	1.68	60.9	58.3	7.53	7.23	2.95	2.32
All single-unit trucks	68.60	68.45	48.8	47.2	2.31	2.31	24.84	24.48
Truck combinations:								
Truck-tractor and semitrailer	29.22	29.43	69.2	68.9	10.48	10.32	67.96	68.87
Truck and trailer	2.18	2.12	65.0	62.3	15.48	15.32	7.20	6.65
All truck combinations	31.40	31.55	68.9	68.5	10.83	10.62	75.16	75.52
All trucks and combinations	100.00	100.00	55.1	53.9	5.66	5.64	100.00	100.00

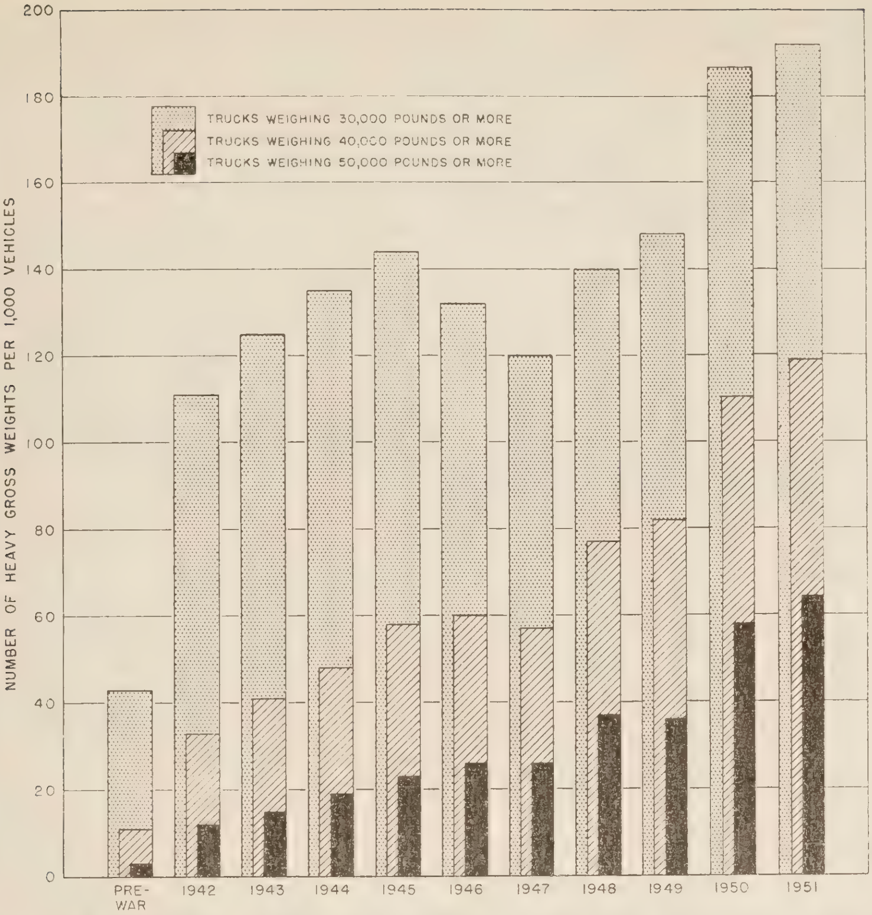

Figure 8.—Number of heavy gross weights per 1,000 trucks and truck combinations (empties included) in the summers of 1942-51 and a prewar year.

in 1936, the earliest year for which comprehensive travel and weight data are available; in 1941, the peak prewar year, 5 years after the beginning of the surveys; in 1946, 10 years after the beginning of the surveys; and in 1950 and 1951 which completes 16 full years of estimates. The ratios of 1951 travel to that of the preceding years indicate that increases for trucks and truck combinations generally were greater than for passenger cars and busses, and that increases for truck combinations were greater than for single-unit trucks. In the 15 years from 1936 to 1951, passenger-car and bus travel combined increased 104 percent, travel by all trucks and combinations increased 163 percent, and travel by truck combinations (considered separately) more than quadrupled, increasing 362 percent.

Volume of Highway Freight

Figure 6 gives a comparison of the average load carried by single-unit trucks and truck combinations, separately and combined, in the 16 years that the planning surveys have been operating. The general trend of load weights was upward throughout the period. The slight decline in the weights of loads carried by single-unit trucks since 1945 has been more than offset by the increased use of combinations and the increased weights of loads carried by vehicles of this type.

Figure 7 shows for each year from 1936 through 1951, the ton-mileage of freight carried by trucks and truck-combinations on main rural roads. The chart demonstrates clearly that truck combinations are transporting each year a larger proportion of the total amount of highway freight. In 1936 the truck combinations hauled slightly less ton-mileage than the single-unit trucks, while in 1950 they hauled more than triple the amount transported by the larger number of lighter vehicles. The rapid rate of annual increase in total freight carried, which took place in 1946 and 1947, was reduced somewhat in 1948 and 1949 to a rate more nearly comparable with that of prewar years. In 1950, however, there was a startling increase in freight ton-mileage somewhat similar to a rise that occurred in 1941. In 1951 the rate of increase was again reduced to one closely comparable with the prewar trend.

In table 6 are shown comparisons of the percentage of vehicles carrying loads, the average carried load, and the ton-mileage carried for single-unit trucks and for truck combinations, separately and combined, in 1951 with corresponding items for other years as in table 5. The trend from 1936 to 1951 of average weight carried, shown graphically in figure 6, and that of the ton-mileage transported during the same period, shown in figure 7, has already been discussed.

The percentage of trucks and truck combinations carrying loads increased notice-

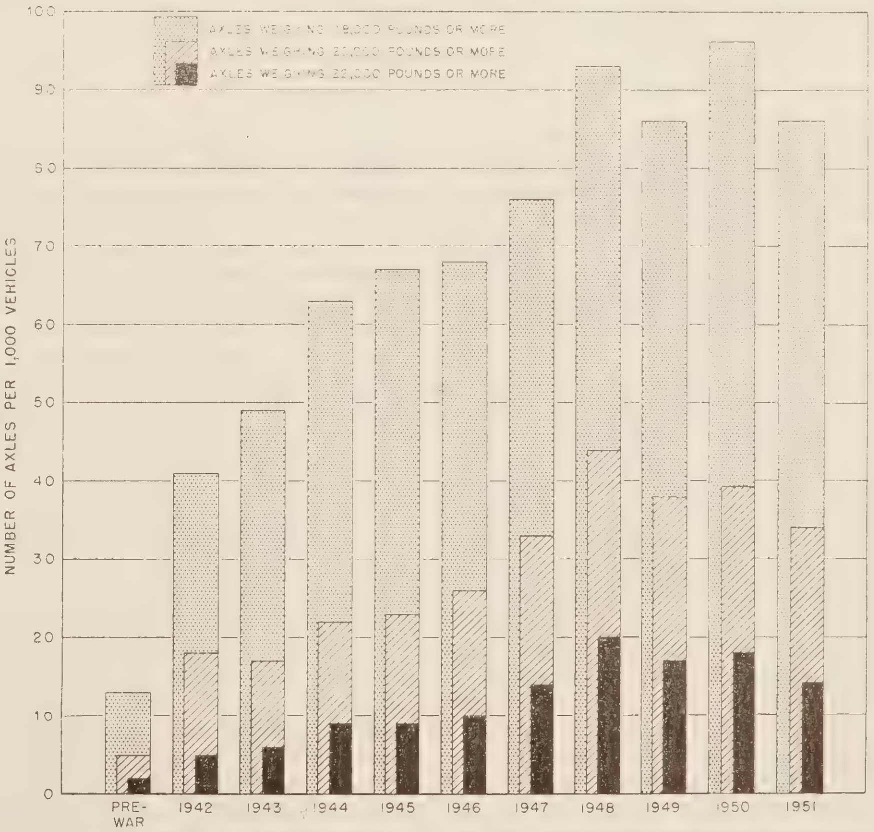

Figure 9.—Number of heavy axle loads per 1,000 trucks and truck combinations (empties included) in the summers of 1942-51 and a prewar year.

Table 8.—Heavy gross weights per 1,000 loaded and empty trucks and truck combinations on main rural roads, summer of 1951

Vehicle type	Eastern regions				Central regions					Western regions			United States average
	New England	Middle Atlantic	South Atlantic	Average	East North Central	East South Central	West North Central	West South Central	Average	Mountain	Pacific	Average	
NUMBER PER 1,000 WEIGHING 30,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	15	26	1	13	0	1	(1)	5	1	5	1	3	5
3-axle	295	522	246	374	232	220	325	339	269	356	319	325	323
Average	16	33	8	18	6	4	6	5	5	11	30	22	12
Truck combinations:													
Truck-tractor and semitrailer	541	631	533	577	586	481	600	511	557	645	712	691	580
Truck and trailer	(2)	(2)	(2)	516	679	(2)	317	(2)	506	818	717	735	637
Average	540	631	532	576	594	481	586	493	554	673	713	702	584
Average, all trucks and combinations	153	234	164	191	255	109	158	143	178	164	289	240	192
Comparative average, 1950	137	221	177	189	251	102	142	146	170	160	289	233	187
Comparative average, 1949	117	191	130	153	208	87	139	107	144	118	176	147	148
NUMBER PER 1,000 WEIGHING 40,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	2	4	0	2	0	(1)	0	0	(1)	0	0	0	1
3-axle	132	292	74	177	46	31	30	89	45	119	52	64	96
Average	5	13	2	7	1	1	1	1	1	3	5	4	3
Truck combinations:													
Truck-tractor and semitrailer	350	425	325	371	345	182	381	310	322	415	560	515	363
Truck and trailer	(2)	(2)	(2)	516	552	(2)	216	(2)	403	551	564	561	496
Average	350	427	325	372	361	183	373	300	326	437	561	526	372
Average, all trucks and combinations	95	152	98	120	154	41	98	85	103	103	216	172	119
Comparative average, 1950	78	135	95	109	140	45	82	79	95	106	214	167	110
Comparative average, 1949	66	120	71	90	105	36	77	54	73	75	121	97	82
NUMBER PER 1,000 WEIGHING 50,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	0	2	0	1	0	(1)	0	0	(1)	0	0	0	(1)
3-axle	29	49	0	25	9	0	0	3	4	69	0	13	14
Average	1	3	0	1	(1)	(1)	0	(1)	(1)	2	0	1	1
Truck combinations:													
Truck-tractor and semitrailer	117	207	123	159	179	25	205	124	150	296	464	411	187
Truck and trailer	(2)	(2)	(2)	452	510	(2)	208	(2)	374	506	482	486	440
Average	116	210	123	160	204	25	205	120	162	330	469	430	204
Average, all trucks and combinations	31	72	36	50	87	6	54	34	51	78	178	138	64
Comparative average, 1950	24	63	28	41	78	7	44	34	47	76	176	133	58
Comparative average, 1949	15	52	21	33	48	6	32	18	29	51	99	75	36

[1] Less than 5 per 10,000.
[2] Data omitted because of insufficient sample.

ably from 1950 to 1951 in all regions except the New England region where a slight decrease of this factor was found. In the country as a whole, the percentage loaded increased from 53.9 percent in 1950 to 55.1 percent in 1951. Both for single-unit trucks and for truck combinations, the percentage loaded was higher in 1951 than in 1950 or any year since 1945. However, the loaded proportion continued to be considerably less for the single-unit vehicles and slightly less for the truck combinations than in the prewar surveys.

Table 7 gives a detailed comparison of the percentage of vehicle-miles of travel, percentage of vehicles loaded, average carried load, and percentage of total ton-miles of freight carried by the various types of trucks and truck combinations traveling on main roads in 1950 and 1951. Many interesting comparisons can be made from this table showing the relative importance from a freight-carrying standpoint of different portions of the traffic stream. In 1951, for instance, while panel and pick-up trucks traveled almost 33 percent of the vehicle-mileage, they accounted for less than 3 percent of the ton-mileage. The truck-tractor and semitrailers, on the other hand, traveled about 29 percent of the vehicle-mileage but carried almost 68 percent of the ton-mileage.

From the column in table 7, showing percentage loaded by types, it can be observed that the percentage of vehicles carrying loads tends to increase directly as the size of the vehicle type, extending from light panel and pick-up trucks that are loaded 39 percent of the time to the heavy combinations that are loaded about 69 percent of the time.

Gross Weights Increase

Figure 8 shows by years, from the prewar years (generally 1936 or 1937) to 1951, for the United States as a whole, the frequency of gross weights of 30,000 pounds or more, of 40,000 pounds or more, and 50,000 pounds or more. The chart shows strikingly how the frequency of heavy loads has increased year after year, reaching amounts in 1951 considerably above any previous level. In this upward climb the 1951 frequencies surpassed even the astonishing maximum levels established for each weight group in the previous year. For instance, the frequency of the loads of 30,000 pounds or more was 3 percent higher than in 1950 and 30 percent higher than in 1949. The loads of 40,000 pounds or more was 8 percent higher than in 1950 and 45 percent higher than in 1949. The increase in loads of 50,000 pounds or more, however, was even more startling, the frequency being 10 percent above the 1950 figure and almost 78 percent above the 1949 figure. The 30,000-pound loads were over 4 times as frequent as in the prewar year; loads of 40,000 pounds or more were 11 times as frequent; while those of 50,000 pounds or more were almost 22 times as frequent as in the 1936–37 period.

The 1951 gross-weight frequency data by vehicle type and region are presented in table 8. No panels, pick-ups, or other two-axle, four-tire, single-unit trucks were found in the survey weighing as much as 30,000 pounds, so there is no entry for these vehicles in the table, though they are included in the total number of vehicles weighed in computing the frequencies for all trucks and combinations. Heavy gross weights are much more frequent in the Pacific region

Table 9.—Heavy axle loads per 1,000 loaded and empty trucks and truck combinations on main rural roads, summer of 1951

Vehicle type	Eastern regions				Central regions					Western regions			United States average
	New England	Middle Atlantic	South Atlantic	Average	East North Central	East South Central	West North Central	West South Central	Average	Mountain	Pacific	Average	
NUMBER PER 1,000 WEIGHING 18,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	45	67	21	43	15	22	20	23	19	31	21	25	28
3-axle	172	332	58	191	10	53	40	64	33	189	29	58	94
Average	29	48	11	27	8	11	11	8	9	16	11	13	15
Truck combinations:													
Truck-tractor and semitrailer	500	523	278	405	180	166	168	197	180	186	106	131	246
Truck and trailer	(1)	(1)	(1)	339	397	(1)	242	(1)	303	191	84	104	189
Average	499	522	278	405	197	166	171	190	187	187	99	124	242
Average, all trucks and combinations	151	207	90	144	88	46	53	60	65	55	44	49	86
Comparative average, 1950	137	208	100	147	98	63	45	67	72	83	69	75	96
Comparative average, 1949	124	195	99	140	89	50	50	51	63	57	37	48	86
NUMBER PER 1,000 WEIGHING 20,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	28	49	7	27	4	6	4	12	6	12	3	6	13
3-axle	104	157	2	81	10	0	0	10	6	123	0	22	37
Average	18	32	3	16	2	3	2	4	3	7	1	4	7
Truck combinations:													
Truck-tractor and semitrailer	321	322	110	221	35	39	43	67	45	56	12	26	99
Truck and trailer	(1)	(1)	(1)	85	26	(1)	13	(1)	19	11	15	14	17
Average	320	320	109	220	34	39	42	64	43	49	13	23	93
Average, all trucks and combinations	97	129	35	79	16	11	12	21	16	17	5	10	34
Comparative average, 1950	82	131	38	80	22	19	12	23	19	35	16	24	39
Comparative average, 1949	73	118	46	78	27	18	12	18	20	26	6	16	38
NUMBER PER 1,000 WEIGHING 22,000 POUNDS OR MORE													
Single-unit trucks:													
2-axle, 6-tire	17	31	3	16	2	2	1	4	2	4	1	2	7
3-axle	33	76	0	37	10	0	0	0	4	43	0	8	16
Average	10	19	1	9	1	1	1	1	1	3	(2)	1	4
Truck combinations:													
Truck-tractor and semitrailer	148	182	31	107	10	9	10	10	10	14	5	7	41
Truck and trailer	(1)	(1)	(1)	(1)	11	(1)	0	(1)	7	1	2	2	4
Average	148	180	31	107	10	9	10	9	10	12	4	6	38
Average, all trucks and combinations	46	73	10	39	5	3	3	4	4	5	2	3	14
Comparative average, 1950	39	80	13	42	7	5	3	9	6	16	3	9	18
Comparative average, 1949	33	65	18	39	9	5	3	6	6	11	2	6	17

[1] Data omitted because of insufficient sample.
[2] Less than 5 per 10,000.

than in other parts of the country. In this region 178 of each 1,000 trucks and truck combinations on the main rural highways in 1951, empties included, weighed 50,000 pounds or more and 289 of each 1,000 weighed 30,000 pounds or more. In the East North Central region, 255 of each 1,000 trucks and truck combinations weighed 30,000 pounds or more, almost as many as in the Pacific region, but only 87 of each 1,000 vehicles weighed 50,000 pounds or more, a frequency less than half of that in the Pacific region for this heavy class of vehicle. The lowest frequency of heavy gross loads was found in the East South Central region where only 6 of each 1,000 weighed 50,000 pounds or more, and only 109 of each 1,000 weighed 30,000 pounds or more.

As was pointed out in the discussion of figure 8, the frequencies of heavy gross loads have increased noticeably in the Nation as a whole. This increase is not limited to any certain area but is distributed throughout the entire country. Comparing the frequencies of gross weights in 1951 with those in the previous year, slight decreases were found in the frequencies of gross weights of 30,000 pounds or more in the South Atlantic region and in the West South Central region; in the frequency of gross weights of 40,000 pounds or more in the East South Central and in the Mountain regions; and in the frequency of gross weights of 50,000 pounds or more in the East South Central region. The frequency of gross weights, 50,000 pounds or more, in the West South Central region did not change nor did the frequency of gross weights of 30,000 pounds or more in the Pacific region. The largest increases were found in the New England region where the frequency of loads of 30,000 pounds or more increased from 137 per 1,000 vehicles in 1950 to 153 in 1951. Also in that region, loads of 40,000 pounds or more increased from 78 in 1950 to 95 in 1951, and those of 50,000 pounds or more increased from 24 in 1950 to 31 in 1951 for each 1,000 vehicles.

Seasonal data collected in 1952 and in a corresponding period in 1951 from the 9 States previously listed, indicate that the frequency of the heavier loads is higher in 1952 than in 1951. This increase is particularly noticeable in the frequency of vehicles weighing 50,000 pounds or more which, in the sample received, were 20 percent more frequent in 1952 than in the earlier year. On the other hand, vehicles weighing 40,000 pounds or more were only slightly more frequent in 1952, while the frequency of those weighing 30,000 pounds or more had not changed appreciably.

Frequency of Heavy Axle Loads

Figure 9 shows the frequency of axle loads of 18,000 pounds or more, 20,000 pounds or more, and of 22,000 pounds or more for the prewar years (1936–37) and by years from 1942 to 1951. The frequency of these heavy axle loads increased year by year from the prewar period through 1948. Since 1948, however, the trend apparently has been reversed for, with the exception of 1950, the data seem to indicate a downward trend or at least a leveling off. Such a leveling off in the frequency of the heavier axle loads, though heavy gross loads have increased in the past year, may indicate that more attention is being given to proper load distribution, due perhaps to better enforcement of legal limits.

Table 10.—Number of trucks and truck combinations, per 1,000 loaded and empty vehicles, that exceeded the permissible axle, axle-group, or gross-weight legal limits in effect in the States by various percentages (maximum) of overload, summer of 1951

Region and type of vehicle	Number per 1,000 overloaded	Number per 1,000 overloaded more than—				
		5 percent	10 percent	20 percent	30 percent	50 percent
New England:						
2-axle, 6-tire	13	9	6	4	2	(1)
3-axle	72	65	53	15	2	.....
Average, single-unit trucks	9	7	5	3	1	(1)
Truck-tractor and semitrailer	114	73	46	16	4	1
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	114	73	46	16	4	1
Average, all trucks and combinations	36	24	16	6	2	(1)
Middle Atlantic:						
2-axle, 6-tire	29	24	19	8	4	1
3-axle	187	152	46	2	.....	.....
Average, single-unit trucks	22	18	12	4	2	1
Truck-tractor and semitrailer	175	134	89	43	16	2
Truck and trailer	267	69	62	56	.....	.....
Average, truck combinations	176	133	89	43	16	2
Average, all trucks and combinations	74	57	38	17	7	1
South Atlantic:						
2-axle, 6-tire	9	6	3	1	.....	.....
3-axle	38	13	6	2	2	.....
Average, single-unit trucks	5	3	2	1	(1)	.....
Truck-tractor and semitrailer	101	71	50	18	6	(1)
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	101	71	50	18	6	(1)
Average, all trucks and combinations	34	23	16	6	2	(1)
East North Central:						
2-axle, 6-tire	8	3	2	1	.....	.....
3-axle	34	19	9	.....	.....	.....
Average, single-unit trucks	5	2	1	1	.....	.....
Truck-tractor and semitrailer	125	65	25	5	1	1
Truck and trailer	221	123	38	8	(1)	(1)
Average, truck combinations	132	69	26	5	1	1
Average, all trucks and combinations	59	30	12	3	(1)	(1)
East South Central:						
2-axle, 6-tire	15	10	7	3	1	(1)
3-axle	56	37	18	7	3	1
Average, single-unit trucks	8	5	4	2	1	(1)
Truck-tractor and semitrailer	129	79	42	15	4	(1)
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	129	79	42	15	4	(1)
Average, all trucks and combinations	35	21	12	5	2	(1)
West North Central:						
2-axle, 6-tire	11	6	4	1	(1)	.....
3-axle	63	21	16	5	.....	.....
Average, single-unit trucks	7	3	2	1	(1)	.....
Truck-tractor and semitrailer	201	118	67	23	11	3
Truck and trailer	79	56	19	.....	.....	.....
Average, truck combinations	195	115	65	22	10	3
Average, all trucks and combinations	56	32	19	7	3	1
West South Central:						
2-axle, 6-tire	24	19	14	8	5	3
3-axle	63	33	17	8	.....	.....
Average, single-unit trucks	9	7	5	3	2	1
Truck-tractor and semitrailer	176	121	78	32	13	2
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	170	117	75	31	13	2
Average, all trucks and combinations	54	38	25	11	5	1
Mountain:						
2-axle, 6-tire	24	15	9	4	2	(1)
3-axle	136	104	89	63	38	12
Average, single-unit trucks	12	8	5	3	2	(1)
Truck-tractor and semitrailer	168	116	74	27	9	2
Truck and trailer	254	130	74	11	2	.....
Average, truck combinations	182	118	74	24	8	2
Average, all trucks and combinations	51	33	21	8	3	(1)
Pacific:						
2-axle, 6-tire	6	3	2	1	1	.....
3-axle	37	18	2	.....	.....	.....
Average, single-unit trucks	6	3	1	(1)	(1)	.....
Truck-tractor and semitrailer	65	33	13	5	(1)	.....
Truck and trailer	132	56	26	7	1	.....
Average, truck combinations	84	40	17	6	(1)	.....
Average, all trucks and combinations	36	17	7	2	(1)	.....
United States average:						
2-axle, 6-tire	15	10	7	3	2	(1)
3-axle	71	46	19	6	3	1
Average, single-unit trucks	9	6	4	2	1	(1)
Truck-tractor and semitrailer	139	89	52	20	7	1
Truck and trailer	157	78	32	7	1	(1)
Average, truck combinations	140	88	51	19	7	1
Average, all trucks and combinations	50	32	19	7	3	(1)
Comparative average, 1950	67	44	27	11	5	1
Comparative average, 1949	51	35	23	10	4	1

[1] Less than 5 per 10,000.

Table 11.—Number of trucks and truck combinations, per 1,000 loaded and empty vehicles, that exceeded any of the permissible load limits recommended by the A.A.S.H.O. by various percentages (maximum) of overload in the summer of 1951

Region and type of vehicle	Number per 1,000 overloaded	Number per 1,000 overloaded more than—				
		5 percent	10 percent	20 percent	30 percent	50 percent
New England:						
2-axle, 6-tire	43	35	29	18	10	4
3-axle	89	76	58	33	17	10
Average, single-unit trucks	25	21	17	10	6	2
Truck-tractor and semitrailer	269	232	194	112	48	9
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	268	231	194	112	48	9
Average, all trucks and combinations	88	76	63	37	17	4
Middle Atlantic:						
2-axle, 6-tire	55	52	47	31	19	7
3-axle	243	201	141	38	13	.....
Average, single-unit trucks	38	35	30	18	11	4
Truck-tractor and semitrailer	302	255	203	125	71	16
Truck and trailer	342	191	130	7	.....	.....
Average, truck combinations	302	255	202	124	70	16
Average, all trucks and combinations	127	109	88	54	31	8
South Atlantic:						
2-axle, 6-tire	16	13	8	2	(1)	.....
3-axle	83	54	30	4	2	.....
Average, single-unit trucks	10	7	4	1	(1)	.....
Truck-tractor and semitrailer	180	133	94	37	10	1
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	180	133	94	37	10	1
Average, all trucks and combinations	61	44	31	12	3	(1)
East North Central:						
2-axle, 6-tire	10	5	3	2	.....	.....
3-axle	19	6	.....	.....	.....	.....
Average, single-unit trucks	6	3	2	1	.....	.....
Truck-tractor and semitrailer	211	136	72	15	5	1
Truck and trailer	406	374	308	171	33	4
Average, truck combinations	226	154	90	27	7	1
Average, all trucks and combinations	99	67	39	12	3	(1)
East South Central:						
2-axle, 6-tire	15	10	7	3	1	(1)
3-axle	44	30	12	.....	.....	.....
Average, single-unit trucks	8	5	4	1	(1)	(1)
Truck-tractor and semitrailer	113	70	34	12	3	(1)
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	113	70	34	12	3	(1)
Average, all trucks and combinations	31	19	11	3	1	(1)
West North Central:						
2-axle, 6-tire	11	6	4	1	(1)	.....
3-axle	38	8	5	3	.....	.....
Average, single-unit trucks	6	3	2	1	(1)	.....
Truck-tractor and semitrailer	173	106	63	18	8	2
Truck and trailer	58	56	19	.....	.....	.....
Average, truck combinations	167	103	61	17	8	2
Average, all trucks and combinations	48	29	17	5	2	1
West South Central:						
2-axle, 6-tire	24	19	15	8	5	3
3-axle	72	33	25	17	8	.....
Average, single-unit trucks	9	7	5	3	2	1
Truck-tractor and semitrailer	165	113	68	27	11	1
Truck and trailer	.....	.....	.....	.....	.....	.....
Average, truck combinations	159	109	66	26	11	1
Average, all trucks and combinations	51	36	22	9	5	1
Mountain:						
2-axle, 6-tire	24	15	9	4	2	(1)
3-axle	137	109	74	56	38	12
Average, single-unit trucks	12	8	5	3	2	(1)
Truck-tractor and semitrailer	199	149	103	46	13	2
Truck and trailer	314	211	123	29	2	.....
Average, truck combinations	218	159	106	43	11	2
Average, all trucks and combinations	59	43	28	12	4	(1)
Pacific:						
2-axle, 6-tire	6	3	2	1	1	.....
3-axle	41	18	2	.....	.....	.....
Average, single-unit trucks	6	3	1	(1)	(1)	.....
Truck-tractor and semitrailer	154	112	71	18	5	(1)
Truck and trailer	278	173	85	10	3	1
Average, truck combinations	189	129	75	16	4	(1)
Average, all trucks and combinations	75	51	29	6	2	(1)
United States average:						
2-axle, 6-tire	21	17	13	7	4	1
3-axle	83	57	35	12	5	1
Average, single-unit trucks	12	9	7	4	2	(1)
Truck-tractor and semitrailer	198	142	94	40	17	3
Truck and trailer	282	211	139	54	10	2
Average, truck combinations	204	147	97	41	17	3
Average, all trucks and combinations	72	52	35	16	7	1
Comparative average, 1950	91	68	46	21	10	3
Comparative average, 1949	68	53	38	19	10	2

[1] Less than 5 per 10,000.

Table 9 gives data concerning the number of heavy axle loads per 1,000 loaded and empty trucks and truck combinations of various types on the main rural roads by regions in 1951. Since no panel or pick-up trucks were found with axles weighing 18,000 pounds or more there is no entry for these in the table though they are included in figuring the frequencies for all trucks and truck combinations.

Though the greatest frequency of heavy gross weights was in the Pacific region, as shown in table 8, the lowest frequency of heavy axle loads was in that region. Frequencies almost as low were found in the West North Central and the East South Central regions. In the Pacific region, only 2 axles of 22,000 pounds or more were found in 1951 for each 1,000 vehicles while in each of the two Central regions mentioned, only 3 such axles were found for each 1,000 vehicles weighed. By far the greatest frequency of heavy axle loads was in the Middle Atlantic region and the next

Table 12.—Number of trucks and truck combinations, per 1,000 loaded and empty vehicles, that exceeded the permissible axle-group loads recommended by the A.A.S.H.O. by various percentages of overload in the summer of 1951

Region and type of vehicle	Number per 1,000 overloaded	Number per 1,000 overloaded more than—				
		5 percent	10 percent	20 percent	30 percent	50 percent
New England:						
2-axle, 6-tire	(1)	...	...	...	...	...
3-axle	75	60	49	27	15	...
Average, single-unit trucks	2	2	1	1	(1)	...
Truck-tractor and semitrailer	64	40	26	7	2	1
Truck and trailer	...	...	...	...	...	...
Average, truck combinations	64	40	26	7	2	1
Average, all trucks and combinations	18	12	8	3	1	(1)
Middle Atlantic:						
2-axle, 6-tire	4	3	3	1	1	...
3-axle	232	186	141	35	13	...
Average, single-unit trucks	11	8	7	2	1	...
Truck-tractor and semitrailer	134	105	72	29	19	4
Truck and trailer	260	62	62	7	...	...
Average, truck combinations	135	105	72	29	19	4
Average, all trucks and combinations	53	41	29	11	7	1
South Atlantic:						
2-axle, 6-tire	(1)	(1)	(1)	...	...	...
3-axle	67	40	25	1	...	...
Average, single-unit trucks	2	1	1	(1)	...	...
Truck-tractor and semitrailer	68	48	34	16	4	(1)
Truck and trailer	...	...	...	...	...	...
Average, truck combinations	68	48	34	16	4	(1)
Average, all trucks and combinations	22	15	11	5	1	(1)
East North Central:						
2-axle, 6-tire	...	...	...	...	...	...
3-axle	9	3	...	...	...	...
Average, single-unit trucks	(1)	(1)	...	...	...	...
Truck-tractor and semitrailer	137	84	45	7	2	(1)
Truck and trailer	384	359	294	164	33	4
Average, truck combinations	156	105	64	19	4	(1)
Average, all trucks and combinations	66	45	27	8	2	(1)
East South Central:						
2-axle, 6-tire	(1)	(1)	(1)	(1)	(1)	...
3-axle	10	10	6	...	...	...
Average, single-unit trucks	(1)	(1)	(1)	(1)	(1)	...
Truck-tractor and semitrailer	11	6	2	1	(1)	...
Truck and trailer	...	...	...	...	...	...
Average, truck combinations	11	6	2	1	(1)	...
Average, all trucks and combinations	2	1	(1)	(1)	(1)	...
West North Central:						
2-axle, 6-tire	...	...	...	...	...	...
3-axle	27	5	5	3	...	...
Average, single-unit trucks	1	(1)	(1)	(1)	...	...
Truck-tractor and semitrailer	116	74	43	12	4	1
Truck and trailer	58	19	12	...	...	...
Average, truck combinations	113	71	41	11	4	1
Average, all trucks and combinations	30	19	11	3	1	(1)
West South Central:						
2-axle, 6-tire	(1)	...	...	...	...	...
3-axle	46	25	25	17	8	8
Average, single-unit trucks	(1)	(1)	(1)	(1)	(1)	(1)
Truck-tractor and semitrailer	84	56	29	9	5	1
Truck and trailer	...	...	...	...	...	...
Average, truck combinations	81	54	28	9	5	1
Average, all trucks and combinations	23	15	8	3	1	(1)
Mountain:						
2-axle, 6-tire	...	...	...	...	...	...
3-axle	130	103	74	53	25	...
Average, single-unit trucks	3	3	2	1	1	...
Truck-tractor and semitrailer	151	117	87	39	11	1
Truck and trailer	254	176	114	25	2	...
Average, truck combinations	168	127	91	37	10	1
Average, all trucks and combinations	41	32	23	9	3	(1)
Pacific:						
2-axle, 6-tire	...	...	...	...	...	...
3-axle	35	9	2	...	...	...
Average, single-unit trucks	3	1	(1)	...	...	...
Truck-tractor and semitrailer	142	107	69	17	5	(1)
Truck and trailer	253	158	74	7	3	1
Average, truck combinations	174	122	70	14	4	(1)
Average, all trucks and combinations	68	47	27	5	2	(1)
United States average:						
2-axle, 6-tire	1	(1)	(1)	(1)	(1)	...
3-axle	71	47	33	11	4	(1)
Average, single-unit trucks	3	1	1	(1)	(1)	(1)
Truck-tractor and semitrailer	107	73	45	14	6	1
Truck and trailer	256	191	127	50	10	2
Average, truck combinations	117	81	51	16	6	1
Average, all trucks and combinations	39	26	17	5	2	(1)
Comparative average, 1950	44	33	22	8	3	1
Comparative average, 1949	28	21	14	7	3	1

[1] Less than 5 per 10.000.

greatest in New England. In these two regions the relatively high frequency is attributable mainly to the large number of two-axle truck-tractors pulling one-axle or two-axle semitrailers. The relative infrequency of heavy axles in the Pacific region, in the presence of a large proportion of heavy gross loads, indicates a better distribution of the loads over a larger number of axles.

Although the frequency of heavy gross loads has increased somewhat in all regions, as stated in connection with the discussion of table 8, the trend in frequency of heavy axle loads followed a different pattern. This is demonstrated by comparing the frequency of heavy axle loads in 1951 with those of 1950, as shown for each region in table 9, and noting that the frequency of heavy axle loads decreased in every region except the New England and West North Central regions, whereas table 8 shows that the frequency of gross loads increased somewhat in most regions.

Seasonal information collected in 1952 and in a corresponding period in 1951, reported by the 9 States previously mentioned, indicates that the frequency of the heavier axle loads may generally be higher in 1952 than in the previous year. However, the data so far available are not sufficient to conclude that the leveling off in the trend of heavy axle load frequencies noted during the preceding few years is temporary only.

Loads Above Legal Limits

Table 10 shows the number of trucks and truck combinations of each type, per 1,000 such vehicles counted, empties included, that exceeded the legal axle, axle-group, or gross-weight limits in effect in the individual States in the summer of 1951, and the number per 1,000 that exceeded these limits by various percentages. Comparative figures are given at the bottom of the table for the Nation as a whole, for 1949 and 1950. It shows that, on the whole, there was much better compliance with legal limitations in 1951 than in 1950 and somewhat better than in 1949. Only three-quarters as many vehicles were overloaded in 1951 as in the previous year, and only two-thirds as many exceeded the State weight limits by 20 percent or more.

Loads in excess of State law were, in 1951, most frequent in the Middle Atlantic States, although even in this region, compared to that of 1950, a slight reduction in the frequency of overloaded vehicles was found. Slight increases in the frequency of overloaded vehicles were found in the New England and in the West North Central regions, but substantial decreases were recorded in all other areas. In the East South Central region, where in 1950 extraordinary conditions in one State caused the highest regional frequency (115 per 1,000) of overloading to be recorded, the 1951 data indicated a frequency of only 35 overloaded vehicles per 1,000 counted. This 1951 frequency in the East South Central region was next to the lowest figure recorded in that year, it being bettered only by the South Atlantic region with a frequency of only 34 excessively loaded vehicles for each 1,000. After the Middle Atlantic region where, of all loaded and empty trucks and truck combinations weighed in 1951, 74 exceeded one or more of the State weight limits, the East North Central region had the second highest rate of overloads (59) and in descending order of rates of violation were the West North Central (56), the West South Central (54), the Mountain (51), the New England (36), the Pacific (36), the East South Central (35), and the South Atlantic (34).

No panel or pick-up truck or other 2-axle, 4-tired truck was weighed that exceeded any of the State weight regulations and these classifications are omitted from tables 10-12 although the number of such vehicles counted is included in the calculations.

Recommended Weight Limits

Uniform regulations concerning maximum allowable gross weights, axle weights, and axle-group weights have been adopted as a policy by the American Association of State Highway Officials and recommended to the State governments for adoption.[6] This policy recommends that no axle shall carry a load in excess of 18,000 pounds and no group of axles shall carry a load in excess of amounts specified in a table of permissible weights based on the distance between the extremes of any group of axles.

The frequencies of axle loads of 18,000 pounds or more, 20,000 pounds or more, and 22,000 pounds or more have already been discussed in connection with table 9 and will not be discussed further here.

As might be expected, many vehicles were so loaded that they exceeded more than one recommended weight limit, and some vehicles had more than one axle loaded in excess of the recommended limit. Counting each vehicle only once, regardless of the number of ways in which it exceeded any of the A.A.S.H.O. recommended limits, table 11 was prepared to show the number of vehicles per 1,000 of each type, both loaded and empty, that exceeded the limits by various percentages. Those vehicles which exceeded more than one provision of the recommended restrictions were tabulated only in the column showing the highest percentage excess of any item.

In the various regions of the United States, the number of vehicles out of every 1,000 that exceeded the recommendations in 1951 was lower in each region except in the West North Central where the frequency of all excessive loads remained the same as in 1950. As might be expected, due to the high frequency of excessively heavy axles in the Middle Atlantic region, as indicated in table 9, that region led all others in the number of vehicles out of every 1,000 that exceeded any of the A.A.S.H.O. recommendations (127 for each 1,000 vehicles counted), while in descending order were the East North Central (99), New England (88), Pacific (75), South Atlantic (61), Mountain (59), West South Central (51), West North Central (48), and East South Central (31).

In the United States as a whole, 72 vehicles out of every 1,000 were overloaded to some degree according to the A.A.S.H.O. standards and 16 out of every 1,000 exceeded some one of the recommended provisions by more than 20 percent. The frequency of vehicles exceeding the recommendations by any amount in 1951 was 21 percent less than in 1950. The frequency exceeding the recommendations by more than 20 percent in 1951 was almost 24 percent less than in the previous year.

Table 12 shows the number of vehicles of various types, per 1,000 vehicles with an axle-group load in excess of the limits recommended by the A.A.S.H.O. and in excess of the limits by various percentages. For the United States as a whole, the frequency of axle-group loads in 1951 was lower than in 1950 though somewhat higher than in 1949. When it is considered that the average weight of all trucks and combinations in 1951 exceeded the average weight of these vehicles in 1950 and that, at the same time, the frequency of axle-group loads in excess of the A.A.S.H.O. recommendations decreased materially, it appears that some effort is being made to reduce load concentrations. The 1951 frequency of excessive axle-group loads in the United States as a whole decreased from the frequencies of 1950 in all regions except in the South Atlantic and the West North Central regions. As in the previous year, the highest frequency of excessive axle-group loads was found in the Pacific region (68 per 1,000 vehicles), while the regions in descending order of the number of vehicles with excessive axle-group loads were East North Central (66), Middle Atlantic (53), Mountain (41), West North Central (30), West South Central (23), South Atlantic (22), New England (18), and East South Central (2).

It will be noted that a higher proportion of the vehicles have excessive axle-group loads in the Pacific region than elsewhere, whereas table 9 shows that this region has the lowest frequency of heavy axle loads. This is because of the widespread use of multiple-axle vehicles in California and neighboring States.

In the United States as a whole, the number of vehicles with excessive axle-group loads per 1,000 counted in 1951 was about 11 percent less than the frequency found in the previous year, and the frequency of those exceeding the recommended amounts by 20 percent or more was about one-third less.

State Limits Higher

In considering the data concerning the frequencies of vehicles exceeding the State legal limits and the A.A.S.H.O. recommendations, especially the frequencies in the Middle Atlantic and New England regions, the fact should be recognized that higher limits generally are permitted under State laws in these areas than are recommended by the Association. Axles exceeding the recommended limits by as much as 25 percent may be within the legal limits of certain States, particularly in these two regions. Some States have no axle-group limits and one State has no prescribed axle-load limit in their motor-vehicle restrictions, a fact that further complicates direct comparison of excess weights based on law and those based on the recommendations. Comparison of the frequency data for New England and the Middle Atlantic regions given in table 11 with those in table 10 shows that only about one-third to one-half of the vehicles exceeding one or more of the Association recommendations actually exceeded a State legal limit. Due to more stringent weight laws in the East South Central, the West North Central, and the West South Central regions, the frequency of vehicles exceeding the State weight limits in the States of these regions is slightly greater than the frequency of those exceeding the Association recommendations. For the United States as a whole, over two-thirds of the vehicles exceeding one or more of the Association recommendations also exceeded a State legal limit.

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[6] *Policy concerning maximum dimensions, weights, and speeds of motor vehicles to be operated over the highways of the United States,* adopted April 1, 1946, by the American Association of State Highway Officials; published by the Association in 1946.

Road Test One—MD

A Motion Picture

Road Test One—MD, a motion picture produced by the Bureau of Public Roads, is now available for lending to interested organizations. The 16-millimeter color and sound film, in three reels, has a running time of about an hour and a quarter. It depicts the operation of and explains the conclusions drawn from the test conducted in 1950 at La Plata, Md., under the direction of the Highway Research Board on behalf of 11 Eastern States and with the cooperation of the Bureau of Public Roads. The final report of the study was recently published by the Board.

In the test, a 1.1-mile section of typical concrete pavement, which had withstood 10 years of weathering and moderate traffic with very slight distress, was subjected to 6 months of continuous controlled truck traffic. On each of four test lanes, pairs of trucks were operated—single-axle trucks with 18,000- and 22,400-pound rear-axle loads, and tandem-axle trucks with 32,000 and 44,800 pounds on the tandem rear axles. Pumping, cracking, deflections and strains, and other evidences of distress and failure were carefully recorded and analyzed in conjunction with data on soils, rainfall, etc.

Part I of the motion picture illustrates the nature and scope of the field operations. Evidence of the effect of the various loadings is shown in a chronological series of scenes focused on typical slabs.

Part II, by means of working models and animated charts, illustrates the data collected and the conclusions derived therefrom. The causes and effects of the phenomena observed are clearly and simply explained in layman's language.

The nature and distribution of the types of soils underlying the pavement, and their relation to pavement failure, are portrayed. The effects of typical rainfalls in the gradual increase of pumping and cracking are demonstrated, followed by a comparison of cracking under the various axle loadings on the uniform basis of lineal feet of cracking per slab on a single type (the predominant A-6) of soil.

A model pavement, supported first by granular soil and then by fine-grained soil, shows how pumping occurs and what are its effects. The model slab, undermined by pumping, is actually broken by a miniature loaded truck. The nature and causes of stresses are demonstrated, and comparisons are made of the magnitudes and locations of stresses caused by single-axle and tandem-axle trucks, on both fully supported and pumped-out subgrades. The cause of longitudinal cracking is demonstrated.

The film ends with a summary of the conclusions drawn from the test, and brief comment on their significance.

Road Test One—MD may be borrowed by any responsible organization, without charge except for the nominal shipping costs, by writing to the Visual Education Section, Bureau of Public Roads, Washington 25, D. C. It is anticipated that there will be considerable demand for this film, and the number of available prints will be limited. In requesting loan of the picture, several alternate dates should be proposed. Loans can be made only for short periods of time.

New Publications

The *Annual Report of the Bureau of Public Roads* for the fiscal year ended June 30, 1952, is now available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 25 cents a copy.

This 81-page publication discusses the progress that was made during the fiscal year in Federal-aid highway planning, programing, and construction, as well as other functions of the Bureau relating to highways.

Accomplishments of the Bureau of Public Roads during the past fiscal year may be summarized in three main categories: the Federal-aid highway construction program, assistance to foreign countries in highway matters, and the research program in fields relating to highway improvement.

During the year the construction program was carried forward with the $500 million Federal-aid authorization together with State and local government matching funds. Work completed involved the improvement of 5,628 miles of principal intercity routes which carry the predominant portion of all rural traffic, the elimination of traffic-congested arteries in many of our populous cities by constructing 772 miles of modern high-speed expressways and other high-type facilities, and the improvement of 11,109 miles of the more important secondary roads serving the rural population. In addition to the regular Federal-aid program, emergency flood relief projects and improvements in National parks and forests totaled 601 miles. The total length of construction projects completed during the fiscal year ending June 30, 1952, at a cost of $846 million was 18,110 miles.

A second phase of the Bureau's activity provided for aid to foreign countries which involved supervising the equipping, training, and organizing of highway departments, and assisting in the planning and restoring of highway systems. Such assistance was made available to Turkey, Ethiopia, Liberia, and the Philippines. During the year, over 220 engineers from more than 54 countries came to the Bureau for assistance in studying American highway practice.

A third phase of the work of the Bureau related to research in the fields of highway finance and administration, highway transport, hydraulics, and physical studies of the properties of highway materials and soils, and the design of pavements and structures.

REPRINTS

Also available from the Superintendent of Documents are reprints of the articles *Highway Transportation Economics* by Richard M. Zettel, appearing in the August 1952 issue of PUBLIC ROADS, vol. 27, No. 3 (10 cents), and *Recent Trends in Highway Bond Financing* by Messrs. Duzan, McCallum, and Todd, appearing in the October 1952 issue, vol. 27, No. 4 (20 cents).

A complete list of the publications of the Bureau of Public Roads, classified according to subject and including the more important articles in Public Roads, may be obtained upon request addressed to Bureau of Public Roads, Washington 25, D. C.

PUBLICATIONS of the Bureau of Public Roads

The following publications are sold by the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Orders should be sent direct to the Superintendent of Documents. Prepayment is required.

ANNUAL REPORTS

Work of the Public Roads Administration:

1941, 15 cents.	1946, 20 cents.	1948, 20 cents.
1942, 10 cents.	1947, 20 cents.	1949, 25 cents.

Public Roads Administration Annual Reports: 1943; 1944; 1945. *(Free from Bureau of Public Roads)*

Annual Reports of the Bureau of Public Roads:

1950, 25 cents.	1951, 35 cents.	1952, 25 cents.

HOUSE DOCUMENT NO. 462

Part 1.—Nonuniformity of State Motor-Vehicle Traffic Laws. 15 cents.

Part 2.—Skilled Investigation at the Scene of the Accident Needed to Develop Causes. 10 cents.

Part 3.—Inadequacy of State Motor-Vehicle Accident Reporting. 10 cents.

Part 4.—Official Inspection of Vehicles. 10 cents.

Part 5.—Case Histories of Fatal Highway Accidents. 10 cents.

Part 6.—The Accident-Prone Driver. 10 cents.

UNIFORM VEHICLE CODE

Act I.—Uniform Motor-Vehicle Administration, Registration, Certificate of Title, and Antitheft Act. 10 cents.

Act II.—Uniform Motor-Vehicle Operators' and Chauffeurs' License Act. 15 cents. *(revised 1952)*

Act III.—Uniform Motor-Vehicle Civil Liability Act. 10 cents.

Act IV.—Uniform Motor-Vehicle Safety Responsibility Act. 15 cents. *(revised 1952)*

Act V.—Uniform Act Regulating Traffic on Highways. 20 cents.

Model Traffic Ordinance. 15 cents. *(revised 1952)*

MAPS

State Transportation Map series (available for 39 States). Uniform sheets 26 by 36 inches, scale 1 inch equals 4 miles. Shows in colors Federal-aid and State highways with surface types, principal connecting roads, railroads, airports, waterways, National and State forests, parks, and other reservations. Prices and number of sheets for each State vary—see Superintendent of Documents price list 53.

United States System of Numbered Highways together with the Federal-Aid Highway System (also shows in color National forests, parks, and other reservations). 5 by 7 feet (in 2 sheets), scale 1 inch equals 37 miles. $1.25.

United States System of Numbered Highways. 28 by 42 inches, scale 1 inch equals 78 miles. 20 cents.

MISCELLANEOUS PUBLICATIONS

Bibliography of Highway Planning Reports. 30 cents.

Construction of Private Driveways (No. 272MP). 10 cents.

Economic and Statistical Analysis of Highway Construction Expenditures. 15 cents.

Electrical Equipment on Movable Bridges (No. 265T). 40 cents.

Factual Discussion of Motortruck Operation, Regulation, and Taxation. 30 cents.

Federal Legislation and Regulations Relating to Highway Construction. 40 cents.

Financing of Highways by Counties and Local Rural Governments, 1931–41. 45 cents.

Guides to Traffic Safety. 10 cents.

Highway Accidents. 10 cents.

Highway Bond Calculations. 10 cents.

Highway Bridge Location. (No. 1486D). 15 cents.

Highway Capacity Manual. 65 cents.

Highway Needs of the National Defense (House Document No. 249). 50 cents.

Highway Practice in the United States of America. 75 cents.

Highway Statistics (annual):

1945, 35 cents.	1947, 45 cents.	1949, 55 cents.
1946, 50 cents.	1948, 65 cents.	1950, 60 cents.

Highway Statistics, Summary to 1945. 40 cents.

Highways in the United States (*nontechnical*). 15 cents.

Highways of History. 25 cents.

Identification of Rock Types. 10 cents.

Interregional Highways (House Document No. 379). 75 cents.

Legal Aspects of Controlling Highway Access. 15 cents.

Local Rural Road Problem. 20 cents.

Manual on Uniform Traffic Control Devices for Streets and Highways. 75 cents.

Mathematical Theory of Vibration in Suspension Bridges. $1.25.

Principles of Highway Construction as Applied to Airports, Flight Strips, and Other Landing Areas for Aircraft. $1.75.

Public Control of Highway Access and Roadside Development. 35 cents.

Public Land Acquisition for Highway Purposes. 10 cents.

Roadside Improvement (No. 191MP). 10 cents.

Selected Bibliography on Highway Finance. 55 cents.

Specifications for Construction of Roads and Bridges in National Forests and National Parks (FP-41). $1.50.

Taxation of Motor Vehicles in 1932. 35 cents.

Tire Wear and Tire Failures on Various Road Surfaces. 10 cents.

Transition Curves for Highways. $1.25.

Single copies of the following publications are available to highway engineers and administrators for official use, and may be obtained by those so qualified upon request addressed to the Bureau of Public Roads. They are not sold by the Superintendent of Documents.

Bibliography on Automobile Parking in the United States.

Bibliography on Highway Lighting.

Bibliography on Highway Safety.

Bibliography on Land Acquisition for Public Roads.

Bibliography on Roadside Control.

Express Highways in the United States: a Bibliography.

Indexes to Public Roads, volumes 17–19, 22, and 23.

Title Sheets for Public Roads, volumes 24, 25, and 26.

STATUS OF FEDERAL-AID HIGHWAY PROGRAM

AS OF DECEMBER 31, 1952

(Thousand Dollars)

STATE	UNPROGRAMMED BALANCES	ACTIVE PROGRAM											
		PROGRAMMED ONLY			PLANS APPROVED, CONSTRUCTION NOT STARTED			CONSTRUCTION UNDER WAY			TOTAL		
		Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles
Alabama	$14,266	$26,072	$13,454	470.7	$8,142	$4,072	200.2	$26,293	$13,420	299.5	$60,507	$30,946	970.4
Arizona	7,367	2,160	1,490	57.5	795	544	16.9	6,556	3,881	73.6	9,511	5,915	148.0
Arkansas	10,434	11,225	5,938	334.5	1,133	583	57.3	13,538	6,939	296.3	25,896	13,460	688.1
California	20,549	22,824	11,469	110.6	8,763	4,517	53.2	95,319	46,063	211.4	126,906	62,049	375.2
Colorado	9,588	6,568	3,622	107.8	2,051	1,095	51.9	8,914	4,358	113.7	17,533	9,075	273.4
Connecticut	8,180	4,500	2,300	20.3	697	348	2.4	10,886	5,557	17.0	16,083	8,205	39.7
Delaware	3,471	679	340	.8	1,061	530	3.3	6,703	3,389	31.9	8,443	4,259	36.0
Florida	9,830	13,375	6,719	177.9	11,226	5,821	131.8	13,804	6,983	230.1	38,405	19,523	539.8
Georgia	15,577	11,958	6,202	300.6	8,070	4,048	94.3	33,457	16,020	512.7	53,485	26,270	907.6
Idaho	7,370	10,210	6,148	281.8	1,893	1,190	47.7	7,077	4,556	87.3	19,180	11,894	416.8
Illinois	29,902	32,962	18,083	309.9	19,679	10,172	109.1	53,760	27,876	405.9	106,401	56,131	824.9
Indiana	19,932	30,854	15,820	135.3	8,320	4,170	126.4	22,440	12,254	131.5	61,614	32,244	393.2
Iowa	15,336	10,912	5,850	212.5	718	372	28.7	10,587	5,347	459.5	22,217	11,569	700.7
Kansas	15,311	7,327	3,581	776.4	5,238	2,576	466.1	11,454	6,159	554.2	24,019	12,316	1,796.7
Kentucky	11,200	12,868	7,022	193.9	6,056	3,224	130.3	13,270	6,551	206.2	32,194	16,797	530.4
Louisiana	9,911	14,386	7,191	111.5	4,872	2,422	33.0	22,922	11,006	137.5	42,180	20,619	282.0
Maine	4,445	6,483	3,529	25.3	315	239	.3	11,324	5,317	82.1	18,122	9,085	107.7
Maryland	10,769	7,788	3,581	57.7	1,584	625	15.9	9,448	5,103	35.2	18,820	9,309	108.8
Massachusetts	13,274	4,232	2,266	14.5	1,158	574	3.1	44,270	21,104	35.1	49,660	23,944	52.7
Michigan	19,307	20,492	10,414	361.4	5,943	2,953	64.3	56,056	24,154	242.7	82,491	37,521	668.4
Minnesota	16,233	8,538	4,764	962.5	1,557	888	69.6	9,876	5,549	235.6	19,971	11,201	1,267.7
Mississippi	10,930	13,174	6,693	470.9	3,185	1,579	103.5	15,444	8,237	404.9	31,803	16,509	979.3
Missouri	17,358	33,501	17,139	895.3	7,050	3,525	103.0	36,986	19,399	388.6	77,537	40,063	1,386.9
Montana	14,688	8,400	5,058	252.9	1,306	785	16.9	13,841	8,312	231.9	23,547	14,155	501.7
Nebraska	19,266	8,771	4,752	418.4	3,934	2,535	44.2	9,868	4,889	264.2	22,573	12,176	726.8
Nevada	6,621	6,176	4,868	191.6	725	606	2.5	4,007	3,000	120.7	10,908	8,474	314.8
New Hampshire	3,381	4,478	2,239	25.8	553	273	4.4	4,373	2,316	25.7	9,404	4,828	55.9
New Jersey	6,590	12,074	5,891	40.4	14,775	6,855	5.3	28,534	14,098	32.2	55,383	26,844	77.9
New Mexico	8,376	1,682	1,076	40.6	1,858	1,189	54.4	6,728	4,304	172.7	10,268	6,569	267.7
New York	46,288	84,719	44,622	148.6	25,904	12,283	36.5	121,244	55,598	401.0	231,867	112,503	586.1
North Carolina	15,130	18,272	8,913	292.7	6,590	3,023	109.4	25,534	12,352	426.7	50,396	24,288	828.8
North Dakota	8,779	4,601	2,433	697.8	738	369	102.1	5,833	2,955	517.8	11,172	5,757	1,317.7
Ohio	27,150	16,916	8,813	101.5	6,902	3,751	20.9	84,113	41,728	142.7	107,931	54,292	265.1
Oklahoma	14,413	10,056	5,623	149.2	5,581	2,800	130.4	20,176	10,566	245.5	35,813	18,989	525.1
Oregon	5,852	6,340	3,725	65.4	1,538	941	10.5	11,348	6,417	161.5	19,226	11,083	237.4
Pennsylvania	33,399	14,288	7,137	29.9	13,135	6,560	49.6	80,774	40,170	167.0	108,197	53,867	246.5
Rhode Island	3,354	3,793	1,897	29.5	769	384	2.7	18,258	9,507	26.7	22,820	11,788	58.9
South Carolina	8,733	10,234	5,487	155.4	2,279	1,215	125.3	15,287	7,843	302.7	27,800	14,545	583.4
South Dakota	7,826	4,168	2,374	365.1	2,899	1,646	142.7	6,208	3,876	362.0	13,275	7,896	869.8
Tennessee	14,224	8,038	3,992	320.8	7,957	3,984	116.3	28,832	13,174	291.1	44,827	21,150	728.2
Texas	31,729	7,851	3,951	160.0	15,672	8,863	376.4	54,919	29,124	925.8	78,442	41,938	1,462.2
Utah	3,898	4,741	3,640	68.7	2,889	2,102	79.8	9,788	7,392	155.1	17,418	13,134	303.6
Vermont	3,170	2,863	1,616	28.0	1,007	499	7.6	6,075	3,035	40.9	9,945	5,150	76.5
Virginia	12,488	10,135	5,030	128.9	5,318	2,609	110.5	25,113	11,982	200.0	40,566	19,621	439.4
Washington	10,709	6,877	3,776	97.2	2,082	1,114	37.4	7,844	4,463	55.6	16,803	9,353	190.2
West Virginia	6,113	6,467	3,267	33.6	6,771	3,464	41.6	16,892	8,427	135.6	30,130	15,158	210.8
Wisconsin	16,554	8,849	5,178	142.2	3,507	1,884	48.4	30,909	15,158	351.0	43,265	22,220	541.6
Wyoming	5,818	615	423	18.6	795	538	18.6	5,362	3,573	96.0	6,772	4,534	133.2
Hawaii	2,850	2,457	1,206	5.4	1,800	899	7.3	13,483	6,098	41.9	17,740	8,203	54.6
District of Columbia	4,330	13,014	5,686	1.2				4,895	2,444	.7	17,909	8,130	1.9
Puerto Rico	5,891	9,499	4,640	67.1	1,034	471	3.2	14,195	6,790	53.2	24,728	11,901	123.5
TOTAL	648,160	609,462	320,928	10,466.1	247,824	127,709	3,617.2	1,214,817	608,813	11,140.4	2,072,103	1,057,450	25,223.7

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